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TROPICAL DISEASES BULLETIN

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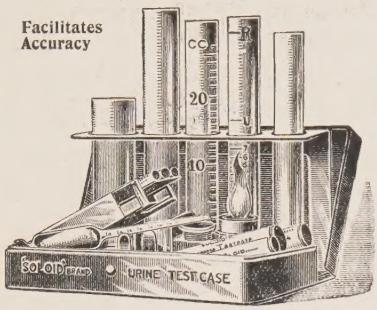

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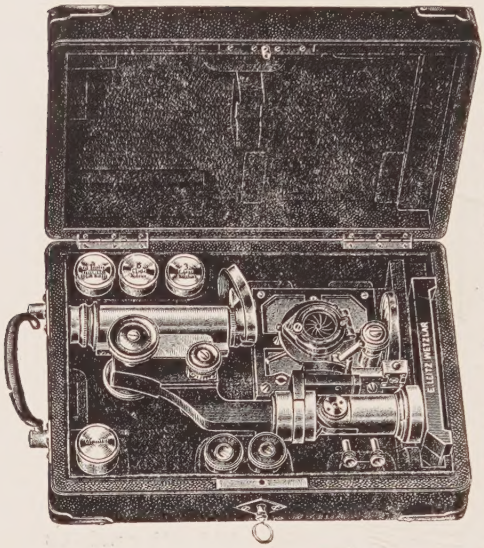

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TROPICAL DISEASES BULLETIN.

Vol. 3.] 1914. [No. 8.

RELAPSING FEVER.

PERTHUISOT. **Note sur la Fièvre Récurrente en Indochine et particulièrement à Thanh-Hoa en 1913.**—*Bull. Soc. Méd.-Chirurg. de l'Indochine.* 1914. Jan. Vol. 5. No. 1. pp. 18-31.

In this interesting article the author brings forward evidence to show that the majority of the epidemics of relapsing fever in Indochina commence during the cold season of the year and disappear during the summer. As a possible explanation it is suggested that the cold may have an effect upon the development of the spirochaete in its intermediate host. [But is it not more likely that the greater crowding together during the winter months, by increasing the risk of lice spreading from one person to another, thereby increases the chance of infection ?].

The author then calls attention to the very limited geographical distribution of the epidemics. Thus one village, Van-tap, was heavily infected whilst all round were crowds of populous towns and villages in none of which were any cases observed. The general mortality of the disease was very high before the employment of salvarsan or neosalvarsan. In 1908 the recorded mortality was 17 per cent; in 1909, 28 per cent; and in both these years the mortality was probably much higher, since cases of malaria were confused with relapsing fever. In 1911, with accurate means of diagnosis, the mortality was 69 per cent; in 1912, after salvarsan was introduced, 7·6 per cent, and in 1913 only 4·2 per cent.

The author invariably employs intravenous injections for the administration of salvarsan and, using doses of 0·15 gm., has never found it necessary to give a second injection.

With regard to prophylaxis the author advises that during the winter months the blood of all patients showing any febrile symptoms should at once be examined for spirochaetes. If infected the patient should be immediately injected with salvarsan and thus the chance of spread of infection reduced to a minimum. In addition the author always cuts off the hair of the patient and has it burnt, thus ensuring that all ectoparasites are destroyed. By applying these methods it has been found possible to arrest epidemics in several of the villages, and there is every hope of relapsing fever gradually disappearing from the country.

E. Hindle.

DUVIGNEAU. **Fièvre Récurrente au Tonkin en 1912. Epidémiologie et Prophylaxie.**—*Ann. d'Hyg. et Méd. Colon.* 1913. Oct.-Nov.-Dec. Vol. 16. No. 4. pp. 849-891.

In this paper the author has collected the records of all cases of relapsing fever occurring in Tonkin during 1912. The first cases probably occurred amongst the miners in the province of Thaï-Nguyen and from this region the disease spread into the other provinces. In all, 1,761 cases were recorded with a mortality of 191 ; most of the cases occurred in the months February, March, April, and May.

The author also gives notes on the clinical features of the disease, without adding anything new, and particulars are furnished as to the methods of administration of salvarsan. This compound was used in the treatment of a certain number of cases with satisfactory results. The intravenous mode of administration was found to be the most convenient.

E. H.

ARMSTRONG (E. R.). **Two Cases of Relapsing Fever.** [Correspondence.] —*Indian Med. Gaz.* 1914. Feb. Vol. 49. No. 2. p. 79.

The author briefly describes two cases of relapsing fever occurring in two riflemen of the Gurkha Rifles shortly after they had returned from Eastern Nepal. Presumably the infection was acquired in this locality and, from the symptoms and the appearance of the parasites, it seems to be identical with that described by STEEN and TOWNSEND, and JUKES (see this *Bulletin*, Vol. 3, pp. 7–8 and Vol. 2, p. 369).

E. H.

BLANCHARD (M.). **Epidémie de Fièvre récurrente à Bikié (Congo français).**—*Ann. d'Hyg. et Méd. Colon.* 1914. Jan.-Feb.-Mar. Vol. 17. No. 1. pp. 81-86.

A summary of this paper has already been published in the *Bulletin de la Société de Pathologie Exotique* (reviewed in this *Bulletin* Vol. 3, p. 4). The present article contains further notes on the epidemic and also remarks on the clinical symptoms. *Ornithodorus moubata* is said to be almost certainly the carrier of the infection, for all patients had been in infested localities. There was no evidence that lice can serve as carriers, for infected and healthy persons lived side by side and, although both were heavily infested with lice, there were no cases of the disease being transmitted in the absence of the tick. Lice collected off infected patients and injected into mice produced no infection in the latter, and therefore it seems unlikely that this insect is able to transmit *S. duttoni*.

E. H.

TRANSMISSION.

TOYODA (Hidezo). **Ueber die Entwicklung von Rekurrensspirochäten in der Kleiderlaus.** [The Development of the *recurrentis* Spirochaete in the Body-louse].—*Zeitschr. f. Hyg. u. Infektionskr.* 1913. Dec. 12. Vol. 76. No. 2. pp. 313-320. With 1 plate.

The author fed a certain number of body lice on mice heavily infected

with *S. recurrentis* and *S. novyi* respectively, and subsequently on normal monkeys. The lice were examined on each successive day in order to determine what became of the spirochaetes after they were ingested. Some of the parasites persisted unchanged in the alimentary canal for at least a week, but the majority of them degenerated very rapidly. Others penetrated through the wall of the gut and appeared in the coelomic fluid, where they have been observed from the second to the seventh day after an infective feed. In addition unchanged spirochaetes were found in the cells of the salivary glands on the seventh day, and the author considers it highly probable that the bite alone of an infected louse will be found to be infective.

The author does not find any evidence in support of the view that the spirochaetes pass through a coccoid phase in the body of the invertebrate host.

[NICOLLE, BLAIZOT and CONSEIL were unable to obtain infection by the bites of lice infected with the North African strain of human spirochaetosis, although one of the subjects was bitten more than 6,000 times. It is therefore unlikely that the bite alone is able to cause infection.]

E. H.

STEFANSKY (V.). **Sur le Problème de l'Infection par la Fièvre Récurrente.**—*Roussky Vratch*, 1913. No. 40. p. 1386. [Reviewed in *Bull. de l'Office Intern. d'Hyg. Publique.* 1914. Feb. Vol. 6. No. 2. p. 361.]

The author has made experiments on the transmission of European relapsing fever (*S. recurrentis*) by the head-louse (*P. capitis*); his results are identical with those obtained by NICOLLE, BLAIZOT, and CONSEIL (see this *Bulletin* Vol. 2, p. 143). The author, however, was unable to find any evidence of hereditary infection in the offspring of infected lice.

E. H.

WOLBACH (S. B.). **The Distribution and Morphology of *Spirochaeta duttoni* and *Spirochaeta kochi* in Experimentally Infected Ticks (*Ornithodorus moubata*).**—*Jl. Med. Research.* 1914. Mar. Vol. 30. No. 1. (New Series, Vol. 25). Whole No. 143. pp. 37-48. With **3 plates.**

Working with strains of human spirochaetes from East and West Africa, respectively, the author has studied the changes undergone by these organisms after ingestion by their invertebrate host, *Ornithodorus moubata.*

The study of uninfected and infected ticks supports MARCHOUX and COUVY's conclusions that the granules in the various epithelial structures of the tick are not connected with the life-cycles of the spirochaetes. The latter were observed to penetrate various cells of the body and also to break up into small granules, but there is no evidence of the infective nature of these and they probably represent degeneration effects.

Spirochaetes, as such, were found in the epithelial cells of the gut, and in the coxal and salivary glands, whilst in some of the connective tissue layers such as the fibro-muscular layer of the gut, the peri-

tracheal fat tissue etc. the organisms were found in such abundance as to support the view that they multiply in these situations. In addition the author observed some of the intracellular spirochaetes to form large granules (distinct from those described by LEISHMAN, BALFOUR, and HINDLE), and also coiled and encysted forms which may possibly represent resting or multiplication stages.

In any case, however, the evidence that granules and granule-clusters are a stage in the life cycle of the spirochaete is purely morphological. The spirochaetes studied, by virtue of their power of invading tissues, may be transmitted in any secretory or excretory product of infected ticks.

The author employed Giemsa's wet method for staining his preparations and found it a reliable method of demonstrating spirochaetes in the tissues of ticks. The paper is accompanied by good photomicrographs illustrating the spirochaetes in the various organs of the tick.

E. H.

GALLI-VALERIO (B.). **Recherches sur la Spirochétiase des Poules de Tunisie et sur son Agent de Transmission : *Argas persicus* Fischer. 3e Mémoire.**—*Centralbl. f. Bakt.* 1. Abt., Orig., 1914. Jan. 24. Vol. 72. No. 6/7. pp. 526-528.

The author agrees with NUTTALL that *Spirochaeta gallinarum* is identical with *S. anserina* Sacharoff and, as the latter name has priority, the term *S. gallinarum* should no longer be employed to designate the fowl spirochaete.

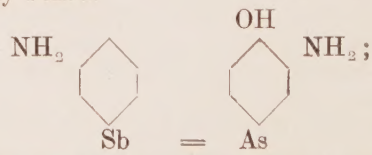
Argas persicus infected with this parasite were found to be no longer infective after 9 to 10 months, but others from Houmt-Souk (Djerba, Tunis), six months after their arrival at Lausanne, produced a mortal infection. The author adds a few notes on the biology of the tick.

E. H.

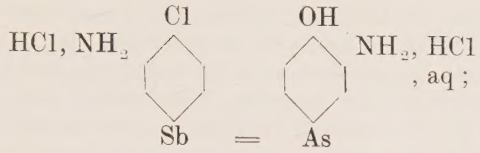
TREATMENT.

UHLENHUTH (P.) & HÜGEL (G.). **Weitere Mitteilungen über die chemotherapeutische Wirkung neuer Antimonpräparate bei Spirochäten- und Trypanosomenkrankheiten.** [Additional Notes on the Chemotherapeutical Action of New Antimony Compounds on Spirochaetoses and Trypanosomiases].—*Deut. Med. Wochenschr.* 1913. Dec. 11. Vol. 39. No. 50. pp. 2455-2457.

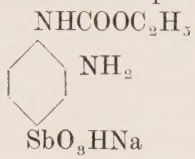
This is a continuation of the authors' previous paper (reviewed in this *Bulletin*, Vol. 1, p. 627), and contains an account of three further organic antimony compounds which have a curative action on fowl spirochaetosis. These compounds are respectively m_1 m^1-diamino-p-oxy-arseno-antimony-benzol



m_1 m^1 diamino-p-oxy-p_1-chlorarseno-antimony-benzol-dichlorhydrate,



and the sodium salt of m-amino-p-urethano-phenyl-antimonate,



In addition the first two of these compounds were found to cure mice infected with nagana and dourine. In the case of mice infected with dourine, the animals could be cured by injections of inorganic antimony compounds, such as colloidal antimony and Sb $(OH)_3$, but these substances had no effect on the course of the disease in fowl spirochaetosis.

From the authors' results it seems however that, effective as some of these new antimony compounds may be in the treatment of spirochaetal infections, they are decidedly inferior to organic mercury-compounds (see this *Bulletin*, Vol. 1, pp. 626–627).

E. H.

NEUFELD (F.) & BOECKER (E.). **Ueber die Wirkung von Salvarsan auf Hühnerspirochäten in vivo und in vitro.** [The Action of Salvarsan on Fowl Spirochaetes *in vivo* and *in vitro*.]—*Zeitschr. f. Immunitätsforsch. u. Experim. Therapie.* 1. Teil., Orig., 1914. Mar. 14. Vol. 21. No. 1/5. pp. 331-341.

The authors find that both salvarsan and neosalvarsan in very dilute concentration kill fowl spirochaetes *in vitro* as well as *in vivo*. A dilution of 1 in 3,000 salvarsan was found to kill spirochaetes, collected on the second day of infection, in three hours; whilst spirochaetes taken on the third day of the disease were killed by 24 hours' exposure to a dilution of 1 in 10,000. These results are especially interesting as at first it was supposed that salvarsan acted on the parasites indirectly through the medium of the body, but the researches of Neufeld and Böcker leave no doubt that this medicament also has a direct toxic action upon the spirochaetes.

E. H.

MOUNEYRAT, TANON & DUPONT. **Action Spirillicide du Galyl et du Ludyl.**—*Rev. de Méd. et Hyg. Tropicales.* 1913. Vol. 10. No. 4. pp. 202-204.

The authors infected eight mice with a virulent strain of *Spirochaeta duttoni* and then divided them into four lots. Two days later, when spirochaetes had appeared in the blood of all the mice, each lot was treated with one of the following substances which were administered subcutaneously in aqueous solution. After the injections the blood of each mouse was examined under the ultramicroscope in order to determine the length of time elapsing before the spirochaetes disappeared.

Lot 1 received 0·00125 gm. of salvarsan and the parasites disappeared after 16 to 20 hours; Lot 2, 0·00125 gm. of neosalvarsan and the parasites disappeared after 25 to 36 hours; Lot 3 received 0·00125 gm. of Galyl and parasites disappeared after five to eight hours, whilst Lot 4 received 0·00125 gm. of Ludyl and parasites disappeared after nine to twelve hours.

From the above results the authors conclude that both Galyl and Ludyl are better sterilising agents than either salvarsan or neosalvarsan.

Ludyl and Galyl were also found to be very effective in the treatment of syphilis, for six hours after injections of 0·5 gm. into syphilitic patients, the *Treponema* had disappeared completely from the chancres, whilst after an injection of salvarsan it is necessary to wait 15 to 24 hours for a similar result, and in the case of neosalvarsan, 24 to 36 hours.

[Although the results with Galyl and Ludyl seem to be extremely favourable, the authors' method of comparing the effects of equal doses is not quite fair. The therapeutic value of any medicament depends also on its toxicity, and therefore, in comparing any compounds, doses of equivalent toxicity should be used. Neosalvarsan, being less toxic than salvarsan, can be used in larger doses, and in this and all other cases the efficiency of a compound is better expressed by giving the ratio $\frac{\text{dosis curativa}}{\text{dosis tolerata}}$.]

E. H.

Conseil (E.). **Le Galyl et le Ludyl dans le Traitement de la Fièvre Récurrente.**—*Bull. Soc. Path. Exot.* 1914. Feb. Vol. 7. No. 2. pp. 101-105. With 2 charts.

In spite of the favourable results obtained in the treatment of relapsing fever by salvarsan and especially neosalvarsan, there is generally a small percentage of cases in which relapses occur after the injection. The author therefore has employed injections of either Galyl or Ludyl, in order to determine whether these compounds were superior in their effects to the above mentioned medicaments. In all, six cases of relapsing fever were injected with Galyl and four cases with Ludyl, and the dose varied from 0·3 gm. to 0·5 gm. Twice the treatment was administered at the end of the first febrile attack, four times at the beginning and three times at the end of the first relapse; and once in the apyretic interval. Although the number of cases treated is very small, yet the author states that in every case the sterilisation of the body was obtained more rapidly than with either salvarsan or neosalvarsan, and above all more radically, for in no patient was there the slightest trace of a relapse.

E. H.

Swift (Homer F.) & Ellis (Arthur W. M.). **A Study of the Spirochaeticidal Action of the Serum of Patients treated with Salvarsan.**—*Jl. Experimental Med.* 1913. Oct. 1. Vol. 18. No. 4. pp. 435-449.

Employing *S. duttoni*, propagated in white rats or mice, the authors have investigated the spirochaeticidal action of the sera of various normal animals that had previously received injections of either sal-

varsan or neosalvarsan. The results are very interesting, for they clearly show that the sera of such injected animals has a definitely toxic effect upon *S. duttoni.*

The method of investigation was as follows:—A suspension of spirochaetes for performing a test was obtained by bleeding a heavily infected mouse or rat into normal saline, and then diluting the blood until it contained a definite number of spirochaetes in each microscopic field. One cubic centimetre of this suspension was mixed with one cc. of the serum, or dilution of serum, to be employed and the resulting mixture incubated at 37° C. for one hour. Half of it was then injected into a mouse while at the same time control mice were injected with an equal quantity of untreated spirochaetes, or spirochaetes mixed with normal serum.

When a rabbit received an intravenous injection of neosalvarsan its serum was found to possess spirochaeticidal properties, which were most marked in the serum taken immediately after the injection and had nearly disappeared at the end of about six and a half hours. Similar results were obtained by employing the sera of human patients that had received injections of salvarsan and neosalvarsan respectively, and from the experiments it seems that the serum of patients treated with neosalvarsan exercises a slightly more spirochaeticidal action than that of patients treated with salvarsan. This difference can also be detected by applying the Abelin diazo reaction for salvarsan to the two sera.

The spirochaeticidal action of the sera of rabbits and patients treated with salvarsan (and neosalvarsan) is markedly increased by heating at 56° C. for thirty minutes. The increased action of such heated sera may be due in part to the destruction of some inhibitory substance contained in normal serum, and in part to a direct effect of the heat upon the serum and salvarsan mixture.

Cerebrospinal fluid does not contain the inhibitory substance present in normal unheated serum and the authors have shown* that the subdural injection of the serum of salvarsan-treated patients has a definite curative action in syphilitic disease of the central nervous system.

E. H.

Laboratory.

Gonder (Richard). **Experimentelle Studien über** *Spironema gallinarum* **und** *Spironema recurrentis.* [Experimental Studies on *Spironema gallinarum* and *Spironema recurrentis.*]—*Zeitschr. f. Immunitätsforsch. u. Experim. Therapie.* 1. Teil. Orig. 1914. Mar. 14. Vol 21. No. 1/5. pp. 309-325.

The author has investigated the question of arsenic resistance in the case of the fowl spirochaete and also *S. duttoni.* (The term *Spironema recurrentis* is employed for the latter.) The strains employed were resistant against salvarsan, and it was found that this resistance was maintained after the parasites had been passed through a number of animals. In addition the natural carriers of these two infections,

* *New York Med. Jl.* 1912. Vol. 96. p. 53.

respectively *Argas persicus* and *Ornithodorus moubata*, were fed on animals infected with the resistant strains and subsequently on normal fowls and mice. The latter became infected respectively with *S. gallinarum* and *S. duttoni*, and it was found that these spirochaetes were still resistant to the drug, although they had passed through the invertebrate host. [It will be remembered that when arsenic-resistant *Trypanosoma lewisi* is transmitted by its invertebrate host, *Haematopinus spinulosus*, the trypanosomes lose their resistance.]

In addition, the author has worked on the immunity following an attack of fowl spirochaetosis. The immunity following an attack of the Sudan strain of fowl spirochaetosis protects a bird against infection with the Brazilian strain, whilst a fowl that has recovered from an attack of the latter can still be infected by injecting it with the Sudan strain.

Finally, a few experiments were performed on the result of passing the fowl spirochaetes through the Java sparrow and subsequently back into fowls, and *vice versa*. The results are very interesting, for a fowl that is immune against a particular strain of spirochaetes can be reinfected if this same strain is first injected into a Java sparrow and then back into the fowl. Similarly a Java sparrow that has recovered from an attack of spirochaetosis is immune against reinfection with the same strain, if the latter is being kept in Java sparrows, but is susceptible to the strain if it has been passed through fowls.

Both fowls and Java sparrows, if they have recovered from two such infections, are immune against reinoculation from either of these birds.

[The number of experiments on which Gonder bases his conclusions is very small—usually only one or two—and considering that the immunity following an attack of fowl spirochaetosis is sometimes incomplete, some of these results require confirmation.]

E. H.

TODD (J. L.) & WOLBACH (S. B.). **Concerning the Filterability of** *Spirochaeta duttoni.—Jl. Med. Research.* 1914. Mar. Vol. 30. No. 1. pp. 27-36.

In this interesting article the authors describe their attempts to filter *Spirochaeta duttoni* through Berkefeld filters, first at atmospheric pressure and later under pressures of fifty pounds to the square inch. Experiments were conducted with four strains of the spirochaete, one from the Congo, another from East Africa and the other two from Central and South Central Africa, respectively. In every case rats were used, and as soon as one was heavily infected it was killed and the blood and organs removed and ground up together in a mortar, with a one per cent. solution of sodium citrate in normal saline. This mixture was then drawn off and filtered two or three times through a Buchner filter. A part of the liquid was then inoculated into a control rat which invariably became infected, whilst the remainder was mixed with some bacillus and filtered through a No. 9 Berkefeld filter either N, W or V.

In addition ticks from various localities, kept either at ordinary temperatures or at 35° C, were ground up in saline and filtered in the same way and also eggs laid by infected ticks were similarly treated.

The results show that *Spirochaeta duttoni* in an infective form cannot be filtered through a Berkefeld filter at atmospheric pressure. On the other hand when the pressure was increased to 50 pounds per square inch an infective form of the spirochaete was forced through the filter, and eight out of eleven animals inoculated with the filtrate became infected.

As the authors remark, there is certainly room for an inquiry into the form in which the spirochaete passes through the filter.

E. H.

LAUNOY (L.) & LÉVY-BRUHL (M.). **Evolution de la Spirillose chez la Poule, après Splénectome.**—*Compt. Rend. Soc. Biol.* 1914. Feb. 27. Vol. 76. No. 7. pp. 298-299.

The authors have splenectomised a number of fowls in order to study the effect of the spleen on the course of the disease in the case of *S. gallinarum.*

The results shew that the evolution of the disease in splenectomised fowls differs slightly from that in normal fowls; in the former the spirochaetes persist in the circulation for a longer period and the infection is more intense; on the other hand the clinical symptoms, and especially the state of intoxication of the animal, are less pronounced.

[The supposed protective rôle of the spleen in the case of protozoal and spirochaetal infections is largely based on the presence of splenomegaly in these diseases. Experiments with *S. recurrentis* and *S. duttoni* tend to support this theory, for in the absence of the spleen the infection is usually more intense than in normal animals. The differences, however, are rarely very marked.]

E. H.

NEIVA (Arthur). **Modo de Comportar-se do *Treponema gallinarum* em Temperaturas baixas.** (Nota prévia.) [The Behaviour of *Treponema gallinarum* at Low Temperatures.]—*Brazil Medico.* 1914. Jan. 1. Vol. 28. No. 1. pp. 1-2.

The author has kept fowl spirochaetes at zero for 49 days, and finds that they still maintain their virulence. In addition he has obtained evidence that the spirochaetes multiply in the extra-vascular blood.

E. H.

WOLBACH (S. B.) & BINGER (C. A. L.). **The Cultivation of a Free-Living Filterable Spirochete (*Spirochaeta elusa;* new species). A Preliminary Report.**—*Jl. Med. Research.* 1914. Mar. Vol. 30. No. 1. (New Ser. Vol. 25). Whole No. 145. pp. 9-22. With 3 plates.

A description of a most interesting spirochaete that developed from the filtrate of water collected from a pond in Boston, U.S.A., and filtered through a Berkefeld "V 2" filter. This organism closely resembles some of the pathogenic spirochaetes, but is peculiar from the fact that it is possible to grow it on solid media (hay infusion agar), when it forms definite colonies similar in appearance to those formed

by ordinary bacteria. In addition, the spirochaete can be cultured with ease in ordinary hay infusion.

[Those interested should consult the original article.]

E. H

MEIROWSKY (E.). **Protozoischer oder pflanzlicher Entwicklungskreis der Spirochäten?** [Is the Development of Spirochaetes Protozoal or Plant-like?]—*Dermatol. Wochenschr.* 1914. Feb. 21. Vol. 58. No. 8. pp. 225-232. With 1 plate.

The author compares corresponding stages in the development and life-cycles of the following organisms:—Tubercle bacillus, leprabacillus, *Spirillum rubrum*, *Spirochaeta gallinarum*, and *Spirochaeta* (=*Treponema*) *pallida*, both from cases of syphilis and also from cultures. Especial attention is devoted to the arrangement of tha chromatic substance and also to the formation of coccoid bodies in the various organisms. After summing up, the author concludes that there is overwhelming evidence in support of the view that the spirochaetes are vegetable and not animal parasites.

[Throughout the whole of his paper Meirowsky does not refer to the work of any English or French investigators with the exception of McDONAGH and LEVADITI. Some of his figures of *S. gallinarum* are taken, without any acknowledgement, from HINDLE's article "On the Life-Cycle of *Spirochaeta gallinarum*."*]

E. H.

MEIROWSKY. **Untersuchungen über die Stellung der Spirochäten im System.** [Researches on the Systematic Position of Spirochaetes.] —*Münchener Med. Wochenschr.* 1914. Mar. 17. Vol. 61. No. 11. pp. 592-596. With 1 plate and 1 text-fig.

The author gives an incomplete resumé of the literature and reasserts the now generally accepted view that spirochaetes belong to the bacteria and not to the protozoa. The only thing new in the article is a description of the occurrence of branched forms of spirochaetes in cultures of *T. pallidum*, *S. gallinarum* and other forms. This most interesting observation is a further support of the bacterial nature of these organisms.

Branched form of *Spirillum rubrum* from a 16-day-old bouillon culture.

E. H.

* *Parasitology* 1911. Vol. 4. pp. 463-477.

SLEEPING SICKNESS.

MESNIL (F.) & BLANCHARD (M.). **Sur l'Identification du Virus d'un Cas de Trypanosomiase humaine contractée au Laboratoire. Note Préliminaire.**—*Bull. Soc. Path. Exot.* 1914. Mar. Vol. 7. No. 3. pp. 196-200.

In May 1912 Professor LANFRANCHI of the Veterinary School at Parma was found to be infected with trypanosomiasis (see this *Bulletin*, Vol. 1, p. 506). The only strains of trypanosomes kept at Parma were those of Nagana and Surra. LANFRANCHI was convinced that the strain with which he was infected was that maintained in his laboratory in May 1912. This strain was sent to the authors and in the present paper is designated "Parme A" [A, animal]. Three weeks later LANFRANCHI visited Paris and numerous trypanosomes were found in his blood. Animals were inoculated with his blood and strain "Parme H" [H, human] was obtained. The present paper deals with the identification of the two strains.

Against the virus "Parme H" the serum of the patient, of guinea-pigs and of goats infected with "Parme H," and the serum of man, goats and a pig infected with *T. gambiense* manifested in general a protective action. The action of the serum from a case of sleeping sickness from the Congo was extremely definite, whilst normal human serum was without effect. The sera of guinea-pigs infected with "Parme A" and of goats infected with nagana or surra were without action on the virus "Parme H"; the sera of these goats had also been shown to be without effect on *T. gambiense.* On the other hand the serum of guinea-pigs infected with "Parme A" had almost always exhibited a certain action on *T. gambiense.* This is anomalous, for according to all the other reactions "Parme A" is quite distinct from *T. gambiense*; the protective action of various sera show it to be allied to Surra. The serum of a surra goat acted on "Parme A" and conversely the serum of a "Parme A" guinea-pig was as active against surra as against "Parme A." These reactions therefore indicate that Parme H=*T. gambiense* and Parme A=*T. evansi*; there is no support for the view that Parme A is nagana or *T. togolense.*

Two goats, A and B, were inoculated with *T. gambiense* and a third, C, with "Parme H." All these contracted identical infections lasting about three months. On recovery they were found to be immune to the virus with which each was infected. The following cross inoculations were then made. Goat A was inoculated with "Parme H," there was no febrile reaction and its blood 8 days later did not infect mice. Tested finally to *T. gambiense* it was still immune. Goat B was also inoculated with "Parme H," there was no febrile reaction but its blood 7 days later infected mice; 17 days later mice did not become infected. A second inoculation of "Parme H" was made in goat B two months after the first, there was no febrile disturbance but merely a certain persistence of the parasites; a mouse inoculated with its blood 14 days later became infected after a prolonged incubation period. A final reinoculation of this goat with *T. gambiense* gave a like result. Goat C was inoculated with *T. gambiense.* There followed a febrile disturbance which did not however reach 40° C. The blood of the goat infected mice on the 7th day after inoculation but not on the 17th day.

There was hence complete immunity in the case of goat A and incomplete immunity in the case of goats B and C, but there is no indication of any difference which would permit of distinguishing between " Parme H " and *T. gambiense.*

A goat, immune to surra, was inoculated with Parme A ; there was neither febrile disturbance nor infection, a fact which supports the view that the two are identical. The goat was then inoculated with " Parme H " ; it contracted an infection lasting 5 months, that is longer than that of the clean goat C.

" Parme A " and " Parme H " behave then as specifically distinct parasites.

It was found that the serum of the patient in question was trypanolytic and " attaching " in a special manner for *T. evansi* even though it did not act on the virus Parme A. The serum of three sleeping sickness patients from the Congo were trypanolytic for *T. gambiense* but only agglutinated Parme H.

Referring to the morphology of the trypanosome infecting LANFRANCHI, the authors insist on the following points : –Firstly the relatively large number of parasites in the peripheral blood, secondly the susceptibility of the guinea-pig and especially the mouse to direct inoculation of the blood of the patient, thirdly the remarkable monomorphism of the trypanosome in the blood of the patient and the earlier passages in the mouse and guinea-pig.

The authors conclude that the virus " Parme H " does not differ from *T. gambiense* and Parme A from *T. evansi.* These two parasites are hence different, or one must assume a transformation of species, which is not in accord with our knowledge of pathogenic trypanosomes. Other observations suggest some doubt as to the absolute identity of the virus " Parme H " with *T. gambiense.* Temporarily the authors will associate with this virus the term *Lanfranchii* without attaching any specific signification to it.*

W. Yorke.

KERR (T. S.). **A Human Recovery from Trypanosomiasis.**– *Jl. Trop. Med. & Hyg.* 1914. Mar. 16. Vol. 17. No. 6. pp. 81-83. With 2 charts.

This paper gives the clinical history of a Mrs. G., who contracted sleeping sickness in Portuguese Loanda in June 1909. The author writes that the points of interest in the case are :

" (1) The high eosinophile count, not usual in trypanosomiasis, though helminths were absent.

" (2) The extraordinary good health enjoyed by the patient in spite of the persistence of the infection. On June 16, 1911, two years after the initial infection, she was playing tennis daily. This was, I think, attributable to the tonic effect of the soamin.

" (3) The large amount of antimony taken internally.

" (4) The curative effect of the intravenous injections of tartar emetic.

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*Professor LANFRANCHI states that the only strain in his laboratory was that which was sent to Paris, which appears to be *T. evansi.* No human strain existed at Parma, yet the trypanosome infecting him turns out to be distinguishable with difficulty, or not at all, from *T. gambiense.* It is certainly hard to reconcile the laboratory findings with LANFRANCHI'S statement. Light might be obtained if we had the history of the trypanosome strains maintained at Parma.—A.G.B

"(5) Whether the course of soamin injections and antimony by the mouth during eighteen months rendered more effective the subsequent intravenous injections of antimony is a matter for conjecture; unquestionably they did her much good, but there can I think be little doubt that the intravenous injections were the active remedial agent and caused the disappearance of the trypanosomes.

"(6) Symptoms having now been absent for so long point, I think, to a real recovery from the disease and not merely to an arrest of its progress."

W. Y.

ANNALES D'HYGIÈNE ET DE MÉDECINE COLONIALES. 1914. Jan.-Feb.-Mar. Vol. 17. No. 1. pp. 262-264. **Un Cas de Trypanosomiase contractée au Congo, observé à Nouméa (Nouvelle Calédonie). Violentes Réactions à la Suite d'Injections intraveineuses d'Emétique. Extrait du Rapport annuel de la Direction du Service de Santé du Groupe du Pacifique.** [Clinique d'Outre-Mer.]

This paper describes the clinical manifestations noted in a case of sleeping sickness contracted in the Congo. Trypanosomes were found in the cerebrospinal fluid in June 1911, and ·75 gm. of atoxyl was administered. The symptoms disappeared and the patient left hospital in July; he returned however at the beginning of November, in spite of the fact that treatment had been continued the whole time. At the end of November an intravenous injection of ·07 gm. of emetic was given. About an hour and a half later there was great vomiting and diarrhoea accompanied by syncope and tremors; the pulse was 112; the attack subsided after about two hours.

Similar attacks followed subsequent injections of emetic. Later, symptoms indicating involvement of the central nervous system developed, the patient became comatose and died at the end of June 1912.

W. Y.

INMAN (W. S.). **Case of Irido-cyclitis occurring as an early Symptom of Trypanosomiasis** (*Trypanosoma gambiense*).—*Proc. Roy. Soc. Med.* 1914. Mar. Vol. 7. No. 5. Sect. of Ophthalmology. pp. 72-73.

The patient was a European who had recently returned from Northern Nigeria. At the time of landing there was slight puffiness of the eyelids and a little inflammation of both eyes. A lotion and quinine were prescribed with the result that the inflammation subsided but some blurring of the left eye persisted. A fortnight later there was a relapse of the inflammation with increased blurring.

The following description of the condition found is given:—

"R.V.= $\frac{6}{5}$, there was no K.P.; the fundus was normal, and the pupil dilated fully with homatropine. L.V.=$\frac{6}{5}$ slowly; there was much fine K.P., no vitreous opacity, and no fundus change visible. He gave a history of slight malaria, but there was no history of dysentery nor of venereal disease, and subsequent inquiry showed that there was no inherited syphilis. On January 14 he had two teeth removed from the upper jaw, but no pyorrhoea was found. On the morning of January 16 he noticed a blur in front of his right eye, and, on examination, many dots of K.P. were found to be present. The iris was of good colour and the pupil reacted well, and the vision was still $\frac{6}{5}$. On January 23 the right eye was a little better. On January 29 the left eye became a little painful, and on January 30 there was more K.P. but very little redness, and no photophobia. Above the lower nasal vessels, a small distance from the disk, there was a small white spot in the fundus the nature of which was doubtful."

On examination of the blood *T. gambiense* was found. W. Y.

Treatment.

Lafont (A.) & Dupont (V.). **Traitement de la Trypanosomiase humaine au Sénégal par le Ludyl et le Galyl.**—*Bull. Soc. Path. Exot.* 1914. Feb. Vol. 7. No. 2. pp. 160-171.

The results are recorded of treating cases of sleeping sickness with ludyl and galyl (see this *Bulletin*, Vol. 2, p. 353). All the patients (4 girls, 5 boys, 8 women and 19 men) were natives. The drugs were administered intravenously. Most of the patients exhibited auto-agglutination of the red cells before treatment, which was commenced as soon as trypanosomes were found. The cervical glands were generally enlarged, and about 75 per cent. of the cases presented the characteristic facies, apathy with a tendency to mutism, and sometimes sleep. In some instances there were tics and hyperaesthesia, rendering treatment difficult and lumbar puncture impossible.

Details of the cases and treatment are given. Albuminuria was noted in about 80 per cent. of the patients, but its presence is no contra-indication for intravenous injections, in fact the symptom is often relieved by treatment. As a measure of prudence frequent analyses of the urine were made to regulate the increasing and spacing of the doses.

As regards the co-existence of other diseases, filariasis, malaria, bilharziasis, various cutaneous eruptions and syphilis were encountered. Ludyl and galyl are without definite action on microfilaria; their action on syphilis is well known, but on malaria the doses given appeared to have no action.

Changes in the myocardium and pericarditis are the only serious contra-indications to intravenous injection of the drugs. The temperature, before and after injection, is a valuable indication; too prolonged an elevation of temperature should make one very circumspect in pushing the treatment.

Twenty-one of the patients treated came from Senegal. They came of their own free will, and on arrival were frequently found to be badly nourished and in a very unfavourable condition for treatment. They had diagnosed themselves as suffering from sleeping sickness, and of 23 who declared themselves infected only two were discharged as uninfected.

All the patients received benefit from the treatment. Transient amelioration of the symptoms was observed with small doses of the drug or when the treatment was insufficiently prolonged. Permanent amelioration was obtained with doses of 5 to 10 cgm. per kilo of body weight. The enlarged lymphatic glands disappeared as also did all other symptoms. Intraperitoneal injections of patas monkeys with 60 to 90 cc. of the blood of patients 30 to 40 days after treatment were negative.

The injections were made intravenously, the drugs being dissolved in water containing sodium carbonate in solution (see this *Bulletin*, Vol. 2, p. 353). The complications following injection are trifling, consisting only of an occasional slight rise of temperature. Escape of the fluid into the perivascular tissue causes pain and subsequently induration, which however disappears without complication.

On injection of ludyl the patient only experiences a sensation of cold, but with galyl he breathes noisily and perceives an odour like that of a struck match.

The results obtained by treatment with ludyl or galyl or a combination of the two are very encouraging, although it would as yet be premature to pronounce definitely on their value.

W. Y.

V. D. HELLEN. **Versuche zur Behandlung von Schlafkranken mit Trixidin.** [On the Treatment of Sleeping Sickness by Trixidin.]—*Deut. Med. Wochenschr.* 1914. Feb. 19. Vol. 40. No. 8. pp. 388-390.

Arsenophenylglycin, salvarsan and neosalvarsan have proved so successful in the treatment of early cases of sleeping sickness in Togo that there is no necessity to try other remedies in these cases. However, even when the nervous system is but slightly involved, the prognosis is doubtful, whilst in those cases exhibiting marked nervous symptoms the prognosis is very unfavourable.

The author decided to try the effectof Trixidin, (30 per cent. suspension of antimony trioxide in oil. See this *Bulletin*, Vol. 2, pp. 134 and 351, and Vol. 3, p. 247). The remedy was used in ten cases, seven of which had relapsed after arsenic treatment and three others previously untreated. Details of the treatment and results of examination of these ten cases are given. Of 28 injections (·2 to ·8 cc.) 24 gave rise to abscesses necessitating surgical treatment. The quantity of the drug absorbed in such cases is naturally unknown. Albuminuria was observed in one of the cases after treatment and, as no other cause for its appearance than the drug could be found, the author writes that in this instance an injurious quantity of the drug had been absorbed without destroying the trypanosomes. Two other cases showed that considerable quantities of the drug may be retained in the body without any curative effect. In one case after Trixidin treatment the glands in the neck became smaller, but no definite conclusion can be reached, as the period of observation is yet too small. The author is of opinion that Trixidin is not to be recommended for the treatment of sleeping sickness.

W. Y.

LURZ (R.). **Versuche mit dem Trypanosomenheilmittel "Trixidin" bei schlafkranken Menschen.** [Experiments with Trixidin in Sleeping Sickness.]—*Arch. f. Schiffs- u. Trop.-Hyg.* 1914. Mar. Vol. 18. No. 6. pp. 212-213.

Seven cases of sleeping sickness, which apart from glandular enlargement exhibited no signs of disease, were treated with Trixidin. Each patient, except one who ran away after the first injection, received two doses of the drug—one into each buttock—two days elapsing between the injections. The amount of Trixidin given in one injection varied from ·1 gm. to ·3 gm. The injections were painful and, owing to the thickness of the suspension, difficult to administer. They were followed by severe abscesses, fever, great pain, and loss of sleep and appetite.

Nine days after the first injection the abscesses were opened. It was found that they had burrowed deep among the muscles and that they contained much pus and unabsorbed Trixidin. The abscesses healed slowly and in one case healing was delayed through necrosis of a portion of the left gluteal muscles.

No benefit was obtained from the treatment; the glands did not decrease in size; in a single case only did the trypanosomes disappear from the blood and gland juice; in this patient the parasites were found in the cerebrospinal fluid.

As a result of this work the author considers Trixidin to be valueless in the treatment of human trypanosomiasis.

W. Y.

WERNER (H.). **Trypasafrol und Trixidin bei menschlicher Trypanosomiasis.** [Trypasafrol and Trixidin in Human Trypanosomiasis.] —*Arch. f. Schiffs- u. Trop.-Hyg.* 1914. April. Vol. 18. No. 7. pp. 246-248.

Two sleeping sickness patients were treated with Trypasafrol; doses up to ·39 gm. were given daily by the mouth. Although a certain trypanocidal effect was noticed in one of the cases, the treatment did not cause the trypanosomes to disappear permanently from the blood.

Two other cases of sleeping sickness were treated with Trixidin. The author is unable to record any definite specific action on the infection either by the inunction method of treatment, which was borne well, or by intramuscular injection, which on account of the pain caused soon had to be discontinued.

W. Y.

DANYSZ (J.). **Traitement du Surra par les Composés arsénicaux et Arséno-argentiques. Rapports entre les Doses tolérées et les Doses curatives.**—*Bull. Soc. Path. Exot.* 1914. Mar. Vol. 7. No. 3. pp. 200-202.

The author has worked out the lethal and curative doses of various arsenical compounds for mice infected with surra. The strain came from MESNIL'S laboratory. He obtained the following results: Atoxyl, largest dose tolerated 4 to 5 mgm., curative dose 3 mgm., ratio 1 to 1; Arsenophenylglycin, largest dose tolerated 1 cgm., curative dose 3 mgm., ratio 3 : 1; chlorhydrate of dioxy-diamino-arsenobenzol (606), largest dose tolerated 2·5 mgm., curative dose ·3 mgm., ratio 8 : 1; sulphate of dioxy-diamino-arseno-benzolate bromoargentic (88^{D}), largest dose tolerated 2·5 mgm., curative dose ·07 mgm., ratio 35 : 1.

The author has found that the product "88" can be injected on several occasions without any inconvenience. It follows that for surra the arsenobromoargentic product is 4 times more active than "606," 10 times more active than arsenophenylglycin and 35 times more active than atoxyl.

W. Y.

MOLDOVAN (J.). **Ueber die Wirkungsart des Atoxyls, Salvarsans und des Menschenserums bei der experimentellen Naganainfektion.**—[The manner in which Atoxyl, Salvarsan and Human Serum act in experimental Nagana infections.]—*Zeitschr. f. Immunitätsforsch. u. Experim. Therapie.* 1. Teil. Orig. 1914. Mar. 14. Vol. 21. No. 1/5. pp. 481-519.

The experiments described in this paper show that the action of atoxyl in nagana infections is direct; the drug acts as such on the trypanosomes. The active principle is not formed through any change due to the body cells, nor is it the excitation of phagocytosis or other protective properties of the body which leads to the destruction of the parasites. The atoxyl is taken up unchanged by the trypanosomes and in their own body they themselves form the destructive poison. The inactivity of the drug in vitro has its explanation in the fact that the animal organism is only so far necessary as it renders multiplication of the parasites possible. This stipulates an increase in the metabolism of the parasites and qualifies them to take up substances and convert them into poisons, which in vitro are indifferent on account of the slight capacity of the parasites for absorbing them. The mechanism of the action of atoxyl may be divided into three phases: the absorption of the drug by the trypanosomes, its reduction in the parasite body, and the action of the toxic reduction product on the trypanosome cell. Atoxyl resistance is not due to a non-absorption of the drug, nor to a failure to reduce it, but to an insusceptibility of the trypanosome cell to the poisonous action of the reduction products.

The parasitotropism is not alone dependent on the nature of the drug nor on its degree of organotropy, it is also really a function of the vitality of the trypanosome itself. It varies under otherwise similar conditions, according to the stage of the infection and to the intensity of the multiplication of the parasites.

Similarly the action of salvarsan, both in trypanosome and spirochaete infections, is directly on the parasites, and its inactivity in vitro may be explained in the same way as in the case of atoxyl.

Human serum acts in experimental nagana infections in the same direct manner. Here also the serum constituent, which in vitro is inactive, is absorbed and in a degree comparable with the metabolic intensity of the parasites changed into an active poison; this appears to be due to reduction as in the case of atoxyl.

The demonstration of an identical manner of action of principles so different justifies the view that the remaining "indirectly" acting substances behave in a similar manner.

W. Y.

UHLENHUTH (Paul) & SEYDERHELM (Richard). **Experimentelle Untersuchungen über den Einfluss elektrischer Schwachströme auf Trypanosomen in vitro und in vivo.** [Experimental Studies on the Influence of Weak (or low-tension) Electric Currents on Trypanosomes *in vitro* and *in vivo*.]—*Zeitschr. f. Immunitätsforsch. u. Experim. Therapie.* 1. Teil. Orig. 1914. Mar. 14. Vol. 21. No. 1/5. pp. 366-377

Besides chemotherapeutic work there have been during the last ten

years repeated efforts to destroy trypanosomes both in vitro and in vivo by purely physical means. A brief resumé of the literature dealing with this subject is given by the authors.

The experiments described in this paper deal with the effects of the electric current on trypanosomes both in vitro and in vivo. It was found that *T. equiperdum* and *T. lewisi* were killed in vitro by a weak electric current (10–15 milliampère) in from 15–50 minutes. On a stage of great activity follows slowing of the movements and death. *T. equiperdum* proved to be more susceptible to the effects of the electric current than *T. lewisi*. By subjecting trypanosomes to non-lethal doses of weak electric current it was found possible to destroy their infectivity. Electrolytically disintegrated trypanosomes (*T. equiperdum* and *T. lewisi*) proved to be toxic for mice. The trypanosome poison prepared in this way appeared to be pre-eminently a nerve toxin.

Under certain experimental conditions it was found possible to kill trypanosomes in vivo by means of weak electric currents.

W. Y.

HALBERSTAEDTER (L.). **Experimentelle Untersuchungen an Trypanosomen über die biologische Strahlenwirkung.** [Experimental Investigations on the Action of various Rays on Trypanosomes.] —*Berlin. Klin. Wochenschr.* 1914. Feb. 9. Vol. 51. No. 6. pp. 252-253.

There already exist a number of observations on the effect of rays on trypanosomes, but the results are somewhat contradictory; thus SALOMONSEN and DREYER found that radium emanations had a strong action on trypanosomes, LAVERAN and MESNIL observed but little effect, whilst LÖWENTHAL and RUTKOWSKY found hardly any. All these authors regarded the motility of the trypanosomes as the criterion of the effect of the rays. This, however, is unsatisfactory, because the motility of trypanosomes outside the body usually quickly decreases; moreover chemotherapeutic experiments have shown that the motility and power of reproduction are not necessarily parallel; the parasites may still preserve their motility and yet have lost their capacity of multiplying in the animal body.

The author noted that trypanosomes which had been subjected to the emanations of radio-active substances (radium, mesothorium, thorium x) remained actively motile long after they had lost the power of infecting experimental animals. The hitherto published results of the influence of radio-active substances on trypanosomes must therefore be revised—the same holds true of Röntgen rays and light rays. For many reasons trypanosomes are most suitable objects for biological experiments with various kinds of emanations. Details of the technique adopted by the author are given; the parasite employed was *T. brucei*.

W. Y.

Immunity.

Schilling (Claus). **Antigene Eigenschaften verschiedener Stämme ostafrikanischer Trypanosomen.** [Antigen Properties of various Strains of East African Trypanosomes.]—*Zeitschr. f. Immunitätsforsch. u. Experim. Therapie.* 1. Teil. Orig. 1914. Mar. 14. Vol. 21. No. 1/5. pp. 358-365.

The trypanosome strains with which we are accustomed to deal in Europe are obtained—with the single exception of the East Prussian dourine strain—from animals naturally infected in the tropics and are hence relapse strains. They are then kept for many years in the normal laboratory animals. Before we understood the significance of relapse strains the strains were passed from one species of animal to another. It is now known that such a procedure may give the strain quite a new character.

The work described in this paper is a continuation of the investigations of Schilling and Rondoni (see this *Bulletin*, Vol. 2, p. 356). The strain "nagana ferox" was taken to German East Africa by Schilling. During the voyage it was maintained by passage through guinea-pigs (Strain Ferox II). It was subsequently examined as regards its immuno-antigen properties and was found to have these feebly developed. Hence Schilling concludes that the passage through guinea-pigs had deprived the strain of the greater portion of its antigen properties.

Another strain of nagana was sent from Hamburg and maintained in rats during the sea voyage. This strain (Strain Ferox III) was however of just as feeble antigen producing power as the previous one. The author had therefore obtained good results with Strain Ferox I, which had been maintained in Berlin for a long period in rats and mice, and no success with Strains II and III.

The antigen producing capacity of three other strains of nagana kept at the present time in German laboratories was examined, and only one was found to furnish a serviceable antigen. During his stay on the coast of German East Africa Schilling examined seven strains of nagana obtained from various naturally infected animals. With one exception none of these strains furnished serviceable antigen.

The following are the conclusions :—

1. The old laboratory strains of Nagana are as a rule not suitable for the preparation of an active immuno-antigen. In Makatumbe a strain of nagana from the Hamburg Institute proved to be best.

2. The genuine strains which were obtained in East Africa are bad immuno-antigen producers.

W. Y.

T. Rhodesiense Infection.

Kleine (F. K.). **Zur angeblichen Identität des *Tr. brucei* und *Tr. rhodesiense*.** [On the alleged Identity of *T. brucei* and *T. rhodesiense*.]—*Zeitschr. f. Hyg. u. Infektionskr.* 1914. Mar. 5. Vol. 77. No. 1. pp. 184-187.

Reference is made to the conclusions of Kinghorn and Yorke that a large proportion of the antelope in the Luangwa Valley is infected with human trypanosomiasis. This finding was criticised by Bevan

because of the disproportion between the number of antelope infected and the amount of sleeping sickness, and because KINGHORN and YORKE had not recorded the presence of *T. brucei* in a heavily infested *morsitans* region. Further work by BRUCE, TAUTE and FISCHER showed that *T. brucei* and *T. rhodesiense* were morphologically identical.

Recently STEPHENS and BLACKLOCK called attention to the fact that the original *T. brucei* is monomorphic and hence readily distinguishable from the dimorphic *T. rhodesiense.* Possibly *T. brucei* has changed through long maintenance in laboratory animals. If only a free flagellated strain is to be referred to as *T .brucei,* then we have the peculiar fact that *T. brucei* has disappeared from Africa; the old nomenclature must be dropped and changed to *T. pecaudi* or *T. ugandae.* BRUCE has re-examined preparations of *T. brucei* made 15 years ago in Zululand and finds that this parasite is identical with his Uganda *T. brucei.*

KLEINE continues by discussing the biological methods of differentiation of trypanosomes. Neither cross immunisation nor serum diagnosis affords much help in distinguishing between *T. brucei* and *T. rhodesiense.*

Referring to the value of pathogenicity as a means of differentiation, KLEINE believes that in most cases different trypanosomes, morphologically similar, may be distinguished by subcutaneous inoculation of a large number of the various experimental animals; he instances the differentiation of *T. congolense* and *T. nanum* by this method. [See, however, the papers of BLACKLOCK and YORKE (this *Bulletin,* Vol. 3, p. 169 and DELANÖE (*loc. cit.* p. 253).] Such a procedure, however, is valueless in the case of *T. brucei* and *T. rhodesiense,* which can only be distinguished through their behaviour in man.

Although we may not be able to distinguish between *T. brucei* and *T. rhodesiense* in game in a sleeping sickness district, nevertheless on epidemiological grounds we must consider the parasites to be different. Numerous Europeans have hunted in *morsitans* areas without contracting sleeping sickness. In many districts of East Africa cattle and dogs die at once from *T. brucei.* and human trypanosomiasis is absolutely unknown. TODD and latterly TAUTE inoculated themselves with *T. brucei* without ill effect, nor did the latter become infected after feeding on himself flies infective with *T. brucei.* [The observation recorded by TODD is given in the *Sleeping Sickness Bulletin,* Vol. 3, p. 174. Blood from a cow suffering from trypanosomiasis (species unknown) was injected into a European with negative result.]

Dealing with the hypothesis that the native population is immune, owing to a slight infection acquired in youth, the author states that he examined some 1,500 children in German East Africa with negative results.

The view that man is resistant and only slightly susceptible to infection is improbable. If an animal becomes infected with a trypanosome which is not pathogenic for it, the infection as a rule quickly dies out; *T. rhodesiense* however kills man.

The question must be considered whether in such Glossina as, owing to the absence of other food, have lived for some time on human blood, *T. brucei* has become accustomed to human serum and on that account infective for man. The experiment of JACOBY who succeeded

in making *T. brucei* in the mouse non-susceptible to human serum and of LEBOEUF, who obtained a strain resistant to the serum of Cynocephalus, are cited. However LEBOEUF found that on inoculating his resistant strain into Cynocephalus infection did not result. KLEINE and FISCHER attempted without success to render *T. gambiense* more virulent in goats by feeding tsetse, during the development of the trypanosome in them, on goats.

Since there is no epidemiological or experimental fact indicating that *T. brucei* is pathogenic for man, it cannot be held that this parasite is identical with *T. rhodesiense*. The conclusions which the English investigators draw from the frequent occurrence of *T. brucei* in wild game cannot be accepted by the author.

W. Y.

WECK. **Beobachtungen über Trypanosomen des Menschen und der Tiere am Rovuma-Flusse.** [Observations on Human and Animal Trypanosomiasis in Rovuma.]—*Arch. f. Schiffs- u. Trop.-Hyg.* 1914. Feb. Vol. 18. No. 4. pp. 113-124.

The author examined a large number of game and some domestic animals in the district of Sasawara in Rovuma, German East Africa, and found trypanosomes by direct examination of the blood in eland, waterbuck, gnu, rappantilope [? sable antelope], reedbuck, bushbuck, ngolombwe [a small species of antelope], lion, serval, and also in goats, dogs and cattle. Monkeys, rats, and dogs were subinoculated from a number of antelopes and cattle with several positive results.

The trypanosome isolated from a waterbuck, although very similar to *T. rhodesiense*, differed from the latter in certain respects, notably that in the waterbuck strain absence of the blepharoplast was not uncommon. The movement of the long forms in fresh preparations was more active in the case of the waterbuck trypanosome than in that of the human parasite. The two strains also exhibited certain biological differences. An antelope was successfully inoculated with infected human blood,* showing that infection of antelope with this parasite may occur in nature through the bites of tsetse flies. If this be true, interference with the game for the purpose of combating the infection must be avoided, lest slightly infected game be driven into hitherto clean regions where the conditions may be favourable for the development of *T. rhodesiense* in Glossina and hence more game and men infected. It would be necessary to annihilate the game completely, and this is a measure which the author regards as impracticable. [This argument is based on the assumption that the human and game trypanosomes are different and that game are only infected with *T. rhodesiense* in those regions in which man is known to be infected, in other words that the game derives its infection from man. If it be granted that game can be infected with *T. rhodesiense* from man, it is difficult to see why *T. rhodesiense* should not have spread amongst antelope as widely as the common pathogenic trypanosomes of domestic stock e.g. *T. vivax* and *T. pecorum*.]

Infected human beings must always be regarded as the most important carriers of the virus and constitute the greatest danger for

*This experiment is not free from objection because the antelope harboured a trypanosome before it was inoculated with *T. rhodesiense*.

A. G. B.

their neighbourhood. In all probability the disease has been smuggled into German East Africa by immigrants from Portuguese territory, so prophylactic measures must be directed towards the systematic examination of all natives entering the colony and medical examination of infected districts for the purpose of detecting and isolating infected cases.

In an appendix the author gives further details of his work. The thick film method of blood examination was always adopted. The investigations were carried on during the colder season of the year (shade temperature at 2 p.m. being 22-24° C. whilst at 5 to 6 a.m. it was only 11° C.). All cases found up to the present are from Portuguese territory or from regions into which Portuguese natives have immigrated. The proportion of infected to non-infected is about 7 per mille. The percentage of infected flies was 5 to 15 per cent (109 infected out of 1,090 examined). [The author does not state with what trypanosomes these flies were infected nor how many of them were actually infective.] Attempts to render laboratory bred *Glossina morsitans* infective by feeding them on sleeping sickness cases were unsuccessful. W. Y.

NYASALAND PROTECTORATE. **Sleeping Sickness Diary. Part xxii.** By the Principal Medical Officer.—10 pp. Zomba. Printed by the Government Printer.

Nineteen additional cases of Sleeping Sickness have been notified during the four months from October to December, making a total for the year 1913 of 64 cases, as compared with 46 cases in 1912 and 38 in 1911. A table is given showing the distribution of the cases notified last year. Of the 64 patients 43 were males and 21 females. Short clinical accounts of the 19 fresh cases are given.

HEARSEY writes that the preventive measures instituted in the Proclaimed area of the Dowa district are reported to be attended with satisfactory results. Clearing operations are progressing satisfactorily; voluntary labour is being employed. The village latrine system, which was instituted to prevent natives from visiting the bush for the purpose of defaecation, is not working as satisfactorily as could be desired, but it is hoped with the application of a little pressure better results will follow. Every effort is being made to induce natives to use timber already felled in the course of clearing operations for hut building and firewood. The chiefs are advised to remove their villages from danger zones, but this is not compulsory.

Probably the Marimba district is infected to the same extent as the Proclaimed area in the Dowa district, 11 cases having been found there during a period of 3 months investigation. The Dedza, South Nyasa and Upper Shire districts, however, have furnished four cases only.

W. Y.

PROPHYLAXIS.

PRIMET. **La Prophylaxie de la Trypanosomiase Humaine en Afrique Equatoriale Française.**—*Trans. xvii Intern. Congress of Med.* London. 1913. Sect. xxi. Trop. Med. & Hyg. Pt. 2. pp. 287-294.

An account is given of the work of inspection and prophylaxis against Sleeping Sickness carried on at Brazzaville. All natives who for purposes of labour are required to move from one part of the

colony to another must present themselves for examination at the local Pasteur Institute, where they are classified as "trypanosomé" or "non-trypanosomé." A strict clinical examination is first practised and any suspects are set aside for further examination. In these, fresh preparations of the blood and gland juice are examined. In the event of this being negative, trypanosomes are sought by centrifuging a quantity of the blood, and finally lumbar punctures may be made, or the patient placed in an isolation camp for observation.

Between October 1909 and December 1912 some 15,570 natives were thus examined at Brazzaville and 843 were found to be infected with sleeping sickness. For purposes of treatment the patients are divided into two classes: (*a*) Those who are sufficiently well to do enough work to maintain themselves; these are required to present themselves for examination and treatment at stated intervals. (*b*) Those who are too ill to work; these are placed in an isolation camp. A description of the camp is given.

Aubert and Heckenroth have studied the action of various medicants with a view to ascertaining which was the most active and most lasting in its effects. They worked successively with orpiment, atoxyl and arsenophenylglycin. A brief summary of their results is given (see this *Bulletin*, Vol. 2, p. 35).

Medical tours have been organized for the purpose of examining outlying villages and treating infected persons. With respect to the general hygienic measures which have been adopted, the author writes that it is a well known fact that trypanosomiasis works greatest havoc amongst a population living in poor hygienic conditions and where the food supply is deficient. Attempts are being made to improve the condition of the natives living in such conditions. Villages situated in thick fly zones have been removed. Clearing of the scrub and bush is being undertaken so far as is possible.

The paper closes with a summary of measures taken to protect Europeans against Sleeping Sickness.

W. Y.

Animal Trypanosomiasis.

Robertson (M.) *Part 1.*—**Report on the Present Condition of the Masindi District of the Northern Province in regard to Cattle Trypanosomiasis.** *Part 2.*—**Report on the Present Condition of the Kafu River District and of Buruli in regard to the Spread of Trypanosomiasis.**—Report to the Colonial Office. Received 9th Dec. 1913.

This report records observations made on a safari in the Northern Province of Uganda during June, July and August of last year.

The author gives the following general summary of her conclusions:

"1. The whole of the country, from the northern part of the Saza of Bulimwesi right up to the Hoima-Masindi Road and the Budongo Forest, must now be looked upon as an area permanently infected with cattle trypanosomiasis. This vast tract, which includes the whole Saza of Buruli, including the bush country to the west of the Lugogo River (Butengesa, Kijogolo, and Kijaguso) has become infected within the last 10 to 13 years from the central focus of the Nakasongola District.

"2. The origin of this whole infection can be traced to the moving of large herds of cattle from the south, south-west, and south-east, into the

Nakasongola District in 1900. These cattle were moved into this *morsitans*-ridden country without being subjected to any examination whatsoever.

"3. The disease was carried north of the Kafu by the moving of a single infected herd from Nakitoma in Buruli to Kibangaya, in the Northern Province, in the year 1906.

"4. The whole of the area aforesaid must be looked upon as *morsitans* country. This fly, *Glossina morsitans*, is responsible for the spread of the disease in question. *Morsitans* extend over large areas beyond the recognised fly-belts; the distribution varies greatly according to the season of the year, the fly invading a very much wider area during the wet months.

"5. The percentage of infected flies in the Masindi fly-belt, which crosses the Masindi Port Road, is 10 per cent, an amazingly high figure. This has been produced in the space of six years.

"6. Trypanosomiasis of all kinds (human and animal) could be stamped out entirely and permanently from any district within two years were it not for the game reservoir. It is important to note in this connection that the cattle trypanosome *T. vivax*, the species which has travelled the most rapidly through this district, is unable to survive in any but the large domestic animals (cattle and goats) and the big game.

"7. All trypanosomes of the Gambiense group (i.e., *T. gambiense*, *T. brucei*, and *T. rhodesiense*) introduced into any part of this country which extends from Bulimwesi to the Budongo Forest will ultimately cause a very serious loss to human life in the fly-belts round Masindi. This loss of life will occur especially among the Europeans travelling between the Victoria Nile via Masindi to the Congo and the Soudan.

"8. In the great opening up of the Buruli District about to take place within the next few months, the most stringent care must be taken to avoid the introduction of any of the human group of trypanosomes. The loss of life in Buruli would probably be slight, but the fly and game would pass such a form quite rapidly to the great main artery of traffic round Masindi, where the fly are distributed in thick belts. Mules, donkeys, and domestic cattle are all capable of conveying this type of trypanosome.

"9. *T. rhodesiense*, pre-eminently a *morsitans* trypanosome, is already present in German East Africa, and *morsitans* extends practically from the German border through Ankole and Katwe to the Northern Province. A narrow range of hills, and a fairly large area of well cultivated land, is all that separates Bulimwesi from the south-western belts. A trypanosome of the gambiense group with posterior nuclear forms was got by Dr. Duke from Ankole during his recent safari.

"10. Precautionary measures are urgently required. All cattle and mule transport must be stopped unless carried out under the most rigid and efficient microscopical examination and quarantine of the animals so employed. All roads in *morsitans* areas (especially and notably the Masindi Port to Butiabwa Road) should be cleared of bush on either side throughout its whole extent, and planted with some low-growing crop, such as cotton or sweet potatoes. The optimum width for the strip of cultivation must be ascertained by experiment. Grass should be systematically burnt at least once yearly in fly country.

"11 It cannot be too seriously urged that, owing to the presence of *morsitans* and large quantities of game, vast tracts of the Uganda Protectorate form at the present time an ideal environment for the fostering and dissemination of human trypanosomiasis.

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*With reference to Miss Robertson's conclusion 7, it may be noted that *T. gambiense* was introduced into Unyoro, including the neighbourhood of Masindi, at least ten years ago, and infected natives passed through it for some years. There is however no evidence of infection arising in this area, but only in surrounding *palpalis* areas. As regards conclusion 9, *T. rhodesiense* has been reported from the southern border of German East Africa, at least 10° south of the equator, but nowhere to the north of this line. The region with which Miss Robertson is dealing is north of the equator, some 11° removed. A.G.B.

"12. Had *T. rhodesiense* been one of the species taken to Nakasongola in 1900, the Masindi Port Road and both the Masindi-Kampala Roads would, at the present time, be absolute death traps. To take any one speciesof trypanosome in the Masindi fly-belt, the fly are infected at least at the rate of thirty per thousand, and in Nyasaland and Rhodesia a percentage of two per thousand has caused sufficient loss of life to call forth two commissions of investigation, and to seriously inhibit the development of certain parts of the country."

Miss ROBERTSON records the existence of an interesting state of affairs at Butiabwa on Lake Albert. Here fly, game and cattle are found in close contact without the disease having appeared. The author considers the reason of this to be that the game which travel round the bush to the north and east of Masindi from the Kafu District are checked by the escarpment and do not travel into the Butiabwa area; hence, as the game area is not continuous, there is no continuity of the reservoir of trypanosome diseases. In the same way the game to the south of the Kafu is not continuous with that north of the river, and so the author concludes that the moving of domestic herds was responsible for bringing the trypanosome diseases into the country north of the Kafu. [This observation if confirmed is obviously one of great importance. The reviewer is however disposed to doubt if antelope anywhere in *morsitans* areas are free from trypanosomes pathogenic to domestic stock. It is difficult to imagine that any natural barrier would prevent a certain number of game, some of which would probably be infected, from migrating from one district to another.] In a covering letter Dr. HODGES, Principal Medical Officer of Uganda, states that he is unable to share Miss ROBERTSON's conclusions as to the urgency of the situation in Uganda with regard to the danger to human life from trypanosomiasis conveyed by *Glossina morsitans.*

W. Y.

BRAUN (H.) & TEICHMANN (E.). **Erfahrungen über die tierischen Trypanosomen-Krankheiten Deutsch-Ostafrikas.** [On the Animal Trypanosome Diseases of German East Africa.]—*Beihefte z. Arch. f. Schiffs- u. Tropenhygiene.* 1914. Jan. Vol. 18. Beiheft 1. pp. 5-39. With 2 text figs. & 1 coloured plate.

TEICHMANN (Ernst). **Die tierischen Trypanosomen-Krankheiten Deutsch-Ostafrikas. (Aus den Ergebnissen einer Studienreise.)**—*Entomolog. Zeitschr.* 1913. Aug. 16. Vol. 27. No. 20. pp. 109–110.

BRAUN (H.). **Ueber die tierischen Trypanosomen-krankheiten Deutsch-Ostafrikas.**—*Berlin. klin. Wochenschr.* 1914. Feb. 16. Vol. 51. No. 7. pp. 297-299.

TEICHMANN (E.). **Uebertragungsversuche mit Glossinen.**—*Berlin. klin. Wochenschr.* 1914. Feb. 16. Vol. 51. No. 7. pp. 299-300.

These four papers deal with the same observations. BRAUN and TEICHMANN refer in some detail to their previous work on immunisation against trypanosome infection by vaccines (see *Sleeping Sickness Bulletin*, Vol. 4, pp. 58 and 293).

The authors examined 487 cattle from different parts of German East Africa and in fresh preparations of the blood of 34 trypanosomes

were found. From 29 of these subinoculations were made into rats or rabbits. In all, 15 strains were thus obtained, but one of them was lost. Of the remaining 14, eight proved to be nagana strains whilst the remaining six corresponded to the *congolense* type.

i. *Nagana.*—All eight strains exhibited the same morphological characters; they were typically dimorphic. They were all pathogenic for rats, but exhibited certain quantitative variations of virulence, some strains killing the animals in 14 days whilst with others the rats lived for as long as 4 months. Mice behaved similarly but the disease was as a rule of shorter duration. In rabbits the disease ran a chronic course and the animals developed the characteristic symptom-complex. The infection produced no external symptoms in guinea-pigs but the majority of the animals died. The biological reactions of these strains were compared with those of a nagana strain (St. 4) taken out to Africa by the authors. The result of this work showed that the antigen of the original East African nagana strains was not identical with that of the European strain. It is noteworthy that the European strain St. 4 could be distinguished from the African nagana strains not only biologically but also morphologically, as it was found to be monomorphic, whereas the African strains were typically dimorphic. [In this connection the paper of Stephens and Blacklock should be consulted (see this *Bulletin,* Vol. 1, p. 662).]

Possibly the African strains had become serum fast through inoculation from rat to rat, and with the object of avoiding this the authors attempted to pass their most virulent strain (St. 90) through Glossina and then to infect rats directly from the tsetse. Their efforts to infect *G. brevipalpis* were not very successful. Large numbers of wild tsetse were caught and fed on laboratory animals, but in not a single case did infection with nagana result although *T. congolense* infections were common. Attempts were then made to infect wild *G. brevipalpis* by feeding them on infected animals, the flies being subsequently fed in groups on rats. Only one rat became infected and this unfortunately developed a double infection of nagana and *T. congolense.* As perhaps the atmospheric conditions might account for this failure to render the tsetse infective, the authors repeated the experiment of Kinghorn and Yorke (see this *Bulletin,* Vol. 1, p. 126). Laboratory bred flies were fed on an infected animal and then placed in an incubator at a temperature of from 30–37° C; the atmosphere was kept moist by means of dishes of water. Development of the trypanosomes was found to have taken place in a proportion of those flies which died during the experiment, and in certain flies examined 16 days after the infecting feed large numbers of developing trypanosomes were found. The flies however did not infect when they fed, but on the contrary inoculation of the abdominal contents into 5 mice gave positive results in 2 cases. From these observations it appears that temperature and humidity influence the development of the trypanosome in the fly. The authors draw attention to the fact that the flies were not able to transmit the trypanosomes by feeding although they harboured virulent parasites.

The tsetse fly strain obtained by successful inoculation of two mice with the abdominal contents of the fly was maintained in rats and its biological reactions examined. It was found that they were analogous to the European strain (St. 4). Another interesting point is that not

only was it biologically similar to the European strain but also morphologically, in that it was no longer dimorphic. On comparing the tsetse fly strain with the various African nagana strains it was found that passage through the fly had not altered its antigen properties.

ii. *Paranagana.*—Amongst the African trypanosomes there is a whole series of parasites characterised by their small size and the shortness of their flagellum. They have been given various names (*T. congolense* BRODEN, *T. pecorum* BRUCE, *T. nanum* LAVERAN, and *T. frobeniusi* WEISSENBORN). Such small trypanosomes were found by the authors in cattle, mules, donkeys, sheep, goats and dromedaries. The parasite is widely distributed in German East Africa. Through inoculation into rats seven strains were obtained. These were examined as regards morphology and pathogenicity. A brief description of the morphology is given; there is nothing in it that calls for special attention; all the seven strains were similar.

The pathogenicity of each of the seven strains for rats, mice, guinea-pigs and rabbits is given. As a rule the various strains gave rise to chronic infections in these animals; there was however considerable variation in their virulence. Many of the rats and guinea-pigs inoculated failed to become infected.

BRAUN writes that it is probable that in addition to tsetse flies other biting insects (Stomoxys and Tabanids) can transmit this trypanosome, as he has found cattle infected in localities where tsetse does not exist.

[It is necessary to draw special attention to the statement that a dimorphic trypanosome after passage through the tsetse changed morphologically in that it became monomorphic. In view of other work along these lines this statement requires further examination before it can be accepted.]

W. Y.

DELANOË (P.). **Le Fonctionnement du Service de Prophylaxie à Bouaké (Côte d'Ivoire) à l'égard des Trypanosomiases animales, du 10 juin au 31 déc. 1913.**—*Bull. Soc. Path. Exot.* 1914. Feb. Vol. 7. No. 2. pp. 152-160. With a map.

This paper describes the prophylactic work, as regards animal trypanosomiasis, carried out on the Ivory Coast since June 1913. The blood of animals passing through Bouaké is systematically examined. Only those beasts in which the blood was negative (a single examination was made) are allowed to descend to the coast; the animals found to be infected were retained at Bouaké; if they were sufficiently fat, they were sent to the butcher. An isolation park is being constructed so that the infected animals can be kept under examination.

In all 4,086 animals (2,115 oxen and 1,971 sheep) were examined. Of these 214 only came from the Ivory Coast, the remaining 3,872 were from Upper Senegal and Niger. Of the 2,115 oxen 445 (21 per cent.) were infected and 99 (4·6 per cent.) were rejected as being too emaciated; of the 1,971 sheep 206 (10·4 per cent.) were infected and 16 (·8 per cent.) were very emaciated. Thus approximately 25 per cent. of the inspected cattle and 11 per cent. of the sheep had to be rejected.

The trypanosomes encountered were, in order of frequency, *T. cazalboui*, *T. dimorphon* and *T. pecaudi*. The last parasite is found

most rarely on microscopic examination. In 89 infected cattle seen in December *T. pecaudi* was encountered only 3 times. The parasite is however much more widely spread than microscopic examination of the cattle blood indicates. It was frequently isolated as a pure strain by subinoculation of rats. This was possible, as *T. dimorphon* in the blood of naturally infected cattle and sheep is only exceptionally infective for rats [see this *Bulletin*, Vol. 3, pp. 169 and 253].

The administrative authority has strongly criticised these sanitary measures; it sees in them only a restriction of commerce. It is however impossible not to recognise that, apart from all prophylactic considerations, the active surveillance exercised at Bouaké has improved considerably the quality of the cattle.

W. Y.

TRAUTMANN (R.). **Inoculation positive de** *Trypanosoma cazalboui* **à un** *Cercopithecus patas.*—*Bull. Soc. Path. Exot.* 1914. Feb. Vol. 7. No. 2. pp. 118-121.

This paper records an instance of successful inoculation of a monkey (*Cercopithecus patas*) with *T. cazalboui*. The monkey was injected subcutaneously with 5 cc. of blood from a naturally infected ox, shortly before the death of the latter; trypanosomes were found in its blood on the sixth day and the animal died after 11½ days. The parasites were found in the blood in small numbers only; auto-agglutination was well marked. Post mortem it was found that there was considerable enlargement of the lymphatic glands.

A native dog, a guinea-pig, a monkey (*Cynocephalus*) and a rat subinoculated from the *Cercopithecus patas* on the 9th day of the disease did not develop the infection, but parasites were found in the blood of a sheep eight days after inoculation and it developed a chronic infection. Two *Cercopithecus patas*, a rabbit, a guinea-pig and a goat were inoculated from the sheep; only the goat became infected.

The author writes that he intends to conduct experiments to ascertain whether *T. cazalboui* obtained from infected calves possesses a particular virulence rendering it pathogenic for *Cercopithecus*. [This paper should be compared with that of BLACKLOCK and YORKE on *T. vivax* in rabbits (see this *Bulletin*, Vol. 3, p. 168).]

W. Y.

MOHLER (John R.), EICHHORN (Adolph) & BUCK (John M.). **The Diagnosis of Dourine by Complement Fixation.**—*Jl. Agricultural Research.* Dept. of Agriculture, Washington. 1913. Nov. 10. Vol. 1. No. 2. pp. 99-107.

After giving a brief account of the history of dourine in the United States the authors discuss the various methods of diagnosis. The recognition of chronic and latent forms of the disease is difficult; it is frequently impossible to demonstrate *T. equiperdum* in affected horses, although the parasite may occasionally be found in the serous exudate of the plaques and in the fluid from the oedematous swellings of the genital organs. Accordingly an investigation was made to determine the reliability of the complement fixation method of

diagnosis. The problem of obtaining a satisfactory antigen proved to be one of considerable difficulty. In the past the most promising results were got by those investigators who employed suspensions of trypanosomes as antigen. The preparation of such suspensions is, however, very laborious and an attempt was made to devise a means, by which an equally reliable antigen could be obtained without such elaborate technique as is involved in the preparation of a suspension of pure trypanosomes.

Owing to the fact that the reaction is not absolutely specific but rather of a group nature, antigen was obtained from the blood and macerated spleens of *T. evansi* infected rats, the material being shaken in a bottle with glass beads for 6 hours, filtered through gauze and carbolised. After various trials it was found that the results obtained from the fresh suspension of the macerated spleen of a rat just dead from surra were the most promising. The spleens were removed and ground up in a mortar with a small amount of salt solution. From time to time more of the salt solution was added and the suspension thus obtained filtered through gauze. The quantity of the suspension from each spleen was made up to 40 cc. by dilution with salt solution. The manner in which the antigen is titrated is described. Half the quantity of antigen which in the negative serum does not inhibit haemolysis, provided this quantity is at least double the amount necessary to produce complete fixation with the positive serum, indicates the titre of the antigen.

For the complement fixation test a haemolytic system consisting of sensitized rabbit serum, normal guinea-pig serum and a 5 per cent. suspension of sheep's erythrocytes was used. The serum to be tested was inactivated and employed in quantities of ·15 c.c. (·02 c.c. was the smallest amount of infected horse serum which caused complete fixation).

The authors are of the opinion that the diagnosis of trypanosome infections of both man and animal by the method of complement deviation is of very great importance. By such means it is possible to determine all infected persons or animals within a short time.

W. Y.

BRUMPT (E.). **Réduvides de l'Amérique du Nord capables de transmettre le *Tryp. cruzi*.**—*Bull. Soc. Path. Exot.* 1914. Feb. Vol. 7. No. 2. pp. 132-133.

A brief review of the literature dealing with the transmission of *T. cruzi* is given. The trypanosome was found in naturally infected *Conorhinus megistus* by CHAGAS and has since been found in naturally infected *C. infestans* and *C. sordidus*. BRUMPT has shown that *T. cruzi* develops in various bugs (*Cimex lectularius*, *C. rotundatus* and *C. boueti*) and in *Ornithodorus moubata*. In conjunction with GONZALEZ LUGO the author found that *Rhodnius prolixus* is able to transmit the infection. Quite recently NEIVA demonstrated that *Rhipicephalus sanguineus* can act as an intermediate host.

BRUMPT fed two larvae of a *Conorhinus* from Texas on a mouse infected with *T. cruzi*. They became infected at the first feed and their faeces contained a pure culture of the parasite.

W. Y.

Bionomics of Glossina.

Lloyd (Ll.). i. **Further Notes on the Bionomics of** *Glossina morsitans* **in Northern Rhodesia.**—*Bull. Entom. Research.* 1914. Apr. Vol. 5. Pt. 1. pp. 49-60. With 4 plates, a map and 1 text fig.

ii. **Note on Scratching Birds and Tsetse-Fly.**—*Ann. Trop. Med. & Hyg.* 1914. Apr. 21. Vol. 8. No. 1. p. 83.

i. The author's summary and conclusions are as follows:—

"1. *G. morsitans* is willing to feed on small mammals, birds and reptiles; its ability to do so depends on their agility. As it haunts the sleeping places of many of these it probably feeds on them to some extent when they sleep.

"2. Reptilian blood is not suitable to *G. morsitans* as a continued diet. Mammalian blood has a slight advantage over avian as a diet, and this is shown by the larger average size of the pupae produced in the laboratory.

"3. Some experiment is necessary to determine finally the relation of *G. morsitans* to the larger mammals. This could be carried out in a large fly-proof cage.

"4. The one feature common to the breeding places found is that in close proximity to each there is some relatively dark place where the mother fly can hide during pregnancy.

"5. Pupae are deposited in much larger numbers close to places where large mammals are certain to pass frequently (*e.g.* paths, native and game, fords, drinking places) than in places in the general bush.

"6. On the high plateau of Northern Rhodesia *G. morsitans* begins to breed freely about the second month of the dry season (July) and almost or entirely ceases to do so in the rainy season."

With reference to (1), the author notes that many of the small mammals are nocturnal and spend their days sleeping in hiding places which are in many cases haunted by tsetse flies. It is a very common experience, he writes, to see tsetse fly out of a burrow in the ground or hollow in a tree, while the number of pupae which are taken in such positions show that they are much frequented by the female flies. It is therefore possible that these small animals supply a larger proportion of the food of the tsetse flies than is generally supposed.

With reference to (2), the reptile used in the author's experiments was the chameleon. The flies did not feed well upon these; they frequently inserted their proboscides without obtaining blood. The editor, Mr. Guy Marshall, points out that, as noted by Carpenter and Duke, *G. palpalis* feeds freely in the Lake Victoria district on monitor lizards. In this case also laboratory experiments indicated the unsuitability of reptilian diet. The small size of the pupae produced on a diet of avian blood is considered by the author to be due to the pressure of the clots of blood which form in the sucking stomach when the flies are so fed.

The author's observations summed up in his fifth conclusion are of special interest. In an area of about two square miles he found 174 breeding places, which he mapped out in relation to the game paths and human paths and a stream. When these were classified as positions yielding less than 10 pupae each, positions yielding from 10 to 50 pupae, and positions yielding between 50 and 150 pupae, it was found that the latter bore a close relation to the paths, nine of them being within a yard and the remaining four less than 100 yards from a path. This is shown on a map. He points out that it is of evident advantage for the newly hatched fly to have a certain supply of food in its immediate neighbourhood. The pupae were found in hollows in trees,

in some instances exposed on the surface of hard clay; below trees or branches sloping at an angle; beneath fallen dead trees or bran hes (the majority); and in a few instances in stumps in termite nests, in the burrows of bush-pig or warthog, and in salt licks. Eight photographs show the character of the breeding places.

ii. From time to time suggestions have been made that various scratching birds, such as guinea fowl, the Indian jungle fowl and the domestic fowl, might keep down Glossina by devouring the pupae. The author notes that guinea fowl are extremely numerous in Northern Rhodesia. He examined the crops of ten at Nawalia in the Luangwa Valley. They contained vegetable matter, small bulbs, roots and flower buds; in three only were insects found and then in very small numbers. No pupae of any kind were recorded. The conclusion is that the guinea fowl is a vegetable feeder.

A. G. B.

AUSTEN (E. E.). **A Dipterous Parasite of** *Glossina morsitans.—Bull. Entom. Research.* 1914. Apr. Vol. 5. Pt. 1. pp. 91-93. With 1 text fig.

This fly was received from Mr. Ll. LLOYD, Ngoa, Northern Rhodesia. It belongs to the family *Bombyliidae*, sub-family *Exoprosopinae*, genus *Villa*, Lioy, and is named *Villa lloydi*, sp. nov. A full description and figure are given. The specimen, 5·75 mm. in length, was bred from a puparium of *Glossina morsitans*. Mr. Austen states that it is the first Dipteron to be recorded as parasitic on a tsetse fly.

A. G. B.

SHIRCORE (J. O.). **Suggestions for the Limitation and Destruction of** *Glossina morsitans.—Bull. Entom. Research.* 1914. Apr. Vol. 5. Pt. 1. pp. 87-90. With a sketch map.

Several months' constant travelling in the "proclaimed area" of Nyasaland has led the author to conclude that it contains at least four "primary centres" which harbour *G. morsitans*. These are shown on a sketch map. He states that flies are found here abundantly throughout the year, being present in these situations when there are none or extremely few elsewhere, and the whole remaining country is bare of grass and foliage. These are the only areas where, in the dry season, water is obtainable. Here in the drought there are herds of game and there is light forest. The author believes that the flies breed at these centres and from them extend into the surrounding country along connecting forest when the conditions become suitable. He advocates that the forest connections, along which radiation takes place, should be cut off early in the year so as to isolate the primary centres, which have been delimitated at the height of the previous dry season. The primary centres should then be destroyed by cutting and subsequently burning.

He also gives the results of clearings made in the neighbourhood of villages, which appear to have been effective in diminishing the flies. Each area must be dealt with, he finds, according to its particular requirements.

A. G. B.

WOOSNAM (R. B.). **Report on a Search for Glossina on the Amala (Engabei) River, Southern Masai Reserve, East Africa Protectorate.**—*Bull. Entomol. Research.* 1914. Feb. Vol. 4. Pt. 4. pp. 271-278. With a sketch map.

The river in question, as is shown on the map, is near the Anglo-German boundary and about 70 miles from the Victoria Nyanza. Some specimens of Glossina were obtained and identified by Mr. AUSTEN as *G. fusca* Walk., a species which is sometimes crepuscular in its habits. Mr. Woosnam suggests that the fact that he was unable to obtain a single specimen during a whole day's search is explained by this. He can testify from personal experience that *G. pallidipes* in East Africa feeds greedily during the whole night, but not during the day time. He remarks that *G. fusca* has not been recorded previously from the East Africa Protectorate, and that the altitude, 5,200 feet, is the highest at which any species of Glossina has been found to exist permanently. The fly was apparently confined to one bank of the river. He notes that natives with their cattle, sheep and goats have been living for many years practically in contact with the fly, in spite of the fact that several sportsmen have lost mules and trek oxen in this region. Of this there are two possible explanations: (1) that the natives are so familiar with the distribution of the fly that they hardly ever expose their cattle to infection; (2) that only a very small percentage of the flies are infective, either owing to the reservoir being very limited or to unfavourable climatic conditions.

A. G. B.

YORKE (Warrington) & BLACKLOCK (B.). **The Differentiation of the more Important Mammalian Trypanosomes.**—*Ann. Trop. Med. & Parasitol.* 1914. Apr. Vol. 8. No. 1. pp. 1-12. With 1 plate.

The authors write that "a given trypanosome may present characteristic features either in the vertebrate or in the invertebrate host, if such exist, and must therefore be examined in both of these where possible." The methods of identification which can be applied to the parasite as it appears in the vertebrate host are reviewed under the following heads: motility, morphology, pathogenicity, symptomatology and serum diagnosis.

For the purpose of differentiating species the authors consider the ordinary qualitative morphological characters such as the presence or absence of a free flagellum, the position of the nucleus, and the size, shape and position of the blepharoplast, to be of more importance than the quantitative characters which require mathematical expression for their appreciation. Dealing with the value of biometric graphs for distinguishing various species of trypanosomes, they consider that in the case of the monomorphic trypanosomes, such as *T. congolense* and *T. vivax*, the curves may be regarded as characteristic. With regard to the polymorphic trypanosomes, such as *T. rhodesiense* and *T. gambiense*, so much diversity of form exists between the curves made by various workers that little or no value can be attached to this method of differentiation. In the opinion of the authors "the only valuable information to be obtained from measuring polymorphic

Group	Sub-Group		Trypansome	Date and designators	Synonyms	Motility	Morp		
							Qualitative Character		
							Flagellum	Blepharoplast	Nu
I	A	1	*T. brucei*	1899 Plimmer & Bradford	....	....	**Always free**	....	.
		2	*T. evansi*	1885 Steel	*T. soudanense* (1907) *T. venezuelense* (1910)	....	,,	....	.
		3	*T. hippicum*	1910 Darling	....	....	,,	....	.
	B	4	*T. equiperdum*	1901 Doflein	....	....	,,	....	.
	C	5	*T. equinum*	1901 Voges	....	....	,,	**Absent**	.
	D	6	*T. vivax*	1905 Ziemann	*T. cazalboui* (1906)	**Very rapid, translatory**	,,	....	.
		7	*T. caprae*	1910 Kleine	....	,, ,,	,,	....	.
		8	*T. uniforme*	1911 Bruce	....	....	,,	....	.
	E	9	*T. transvaaliense*	1903 Laveran	....	....	,,	**Near nucleus**	.
		10	*T. theileri*	1902 Laveran	....	....	,,	....	.
	F	11	*T. ingens*	1909 Bruce	....	....	,,	Near nucleus	.
		12	*T. tragelaphi*	1913 Kinghorn & Yorke	....	....	,,	Near nucleus	.
	G	13	*T. lewisi*	1881 Kent	....	**Very rapid, translatory**	,,	**Rod shaped, transverse**	Junctio and mi
	H	14	*T. cruzi*	1909 Chagas	....	Tumbling movement	,,	**Large ovoid**	.
II	I	15	*T. congolense*	1904 Broden	*T. dimorphon* (1904) *T. pecorum* (1910) *T. confusum* (1909)	....	**Never free**	....	.
		16	*T. nanum*	1905 Laveran	....	....	,,	....	.
	J	17	*T. montgomeryi*	1909 Laveran	....	....	,,	....	.
	K	18	*T. simiae*	1912 Bruce	*T. ignotum* (1912)	....	,,	Frequently projects as lateral excrescence	.
III	L	19	*T. gambiense*	1902 Dutton	....	....	**Sometimes free and sometimes not**	....	.
		20	*T. multiforme*	1912 Kinghorn & Yorke	....	....	,,	....	.
		21	*T. nigeriense*	1913 Macfie	....	....	,,	....	.
	M	22	*T. pecaudi*	1907 Laveran	....	....	.	....	**Posteri forms**
		23	*T. rhodesiense*	1910 Stephens & Fantham	....	....	,,	....	
		24	*T. ugandae*	1913 Stephens & Blacklock	*T. brucei* (Uganda) (1909)	....	,,	....	
		25	*T. equi*	1913 Blacklock & Yorke	....	....	,,	....	

More Important Mammalian Trypanosomes

LOGY		Quantitative Characters				Pathogenicity	Development in insect host when known	Where first found	Remarks
us	Cytoplasm	Length in microns		Breadth in microns					
		Min.	Max.	Min.	Max.				
	....	18	34	..		Acute for all laboratory animals	Unknown	Zululand	
	....	18	34	1·5	2	,, ,, ,,	,,	India	
	....	18	28	1·5	3	,, ,, ,,	,,	Central America	
	....	16	35	..		,, ,, ,,	**Transmitted by coitus**	North Africa	Causes characteristic 'plaques'
	....	Average 23		1·5		,, ,, ,,	Unknown	South America	
	Club-shaped	16	31	2	3	**Equidae and ruminants only**	Limited to the proboscis in glossina	Cameroon	
	Heavier build than *vivax*	18	32	**1·75**	**4·25**	,, ,,	,, ,, ,,	German East Africa	
	....	**12**	**19**	1·5	2·5	,, ,,	,, ,, ,,	Uganda	
	....	**18**	**50**	4	6	Slight to bovidae only	Unknown	Transvaal	
	....	**25**	**70**	2	5	,, ,,	Possibly hippobosca, details unknown	Transvaal	
	Myonemes	**72**	**122**	7	10	Unknown	Unknown	Uganda	
	,,	**52**	**72**	5	8·5	,,	,,	N.E. Rhodesia	
of ant. e thirds	....	Average 24		..		**Rats only infected**	Intestines of rat fleas and lice	(World wide)	
	....	Average 20		..		Slight for laboratory animals	....	Brazil	**Dividing forms not seen in blood ?**
	....	8	19	Average 1·5		**Acute for all laboratory animals**	Gut and proboscis of glossina	Congo	Probably these trypanosomes are identical
	....	10	16	Average 1·5		**Equidae and ruminants only ?**	,, ,,	Soudan	
	Heavier build than *congolense*	10	20	**Average 3·3**		Slight for laboratory animals	Unknown	N.E. Rhodesia	
	....	12	23	..		**Acute for monkeys and pigs only**	Proboscis of *Glossina morsitans*	Nyasaland	
	....	13	39	..		Acute for laboratory animals	**Gut and salivary glands of glossina**	Gambia	
	....	10	33	..		Slight for laboratory animals	Unknown	N.E. Rhodesia	
	....	8	37	..		,, ,,	,,	Nigeria	
clear	....	14	35	..		Acute for laboratory animals	**Gut and proboscis of glossina ***	Senegal	* Roubaud & Bouet's observation
	....	12	39	..		,, ,,	**Gut and salivary glands of glossina**	N.E. Rhodesia	
	....	13	38	..		,, ,,	,, ,, ,,	Uganda	
	....	14	36	..		,, ,,	**Transmitted by coitus**	North Africa	

trypanosomes is the range of variation in size of the individuals, or in other words, the maximum and minimum lengths."

The accumulated evidence of recent years has shown that pathogenicity is by no means so reliable a criterion for differentiation of trypanosome species as was formerly thought. Their virulence has frequently been increased by long passage through laboratory animals. An example of this is seen in the case of *T. gambiense.*

" In so far as small laboratory animals and goats, donkeys and horses are concerned, it is impossible to state from the symptoms exhibited with which species of trypanosome the animals are infected." " Subcutaneous swellings, loss of hair, blepharitis, interstitial keratitis, oedema and ulceration of the genitals and mucous membranes are produced equally by many different species of trypanosomes." Probably the plaques seen in horses suffering from dourine are characteristic of this infection.

Regarding agglutinins, cytolytic sera, phagocytosis, phenomenon of attachment and complement deviation, as these are probably not specific they are of no diagnostic value. The authors have no personal experience of the value of immunisation and cross immunisation.

The paper concludes with a consideration of the value, as an aid to differentiation of species, of the cycle of the trypanosomes in their invertebrate hosts. As it seems probable " that all varieties of tsetse are capable of transmitting most, if not all, of the African pathogenic trypanosomes," the fact that a certain trypanosome is known to be transmitted by a particular tsetse does not warrant the differentiation of the trypanosome from another known to be spread by a different tsetse fly. The manner in which the parasite affects the tsetse is, however, of great importance. " By this means the African trypanosomes may be divided into the following three groups :—(i) Those in which the development of the parasite is limited to the proboscis, *T. vivax* (*T. cazalboui*), *T. uniforme*, *T. caprae.* (ii) Those in which the first portion of the developmental cycle takes place in the gut and from thence the infection spreads forwards and takes up its anterior station in the proboscis, *T. nanum*, *T. congolense*, *T. simiae*, *T. pecaudi.* (iii) Those in which the first portion of the cycle takes place in the gut and the final portion in the salivary glands, e.g., *T. gambiense*, *T. rhodesiense* and a polymorphic trypanosome described by Duke in Uganda."

The period of incubation of trypanosomes in Glossina and their morphological characters in the fly are of no value as an aid to differentiating species.

The table in which the salient characters of the more important mammalian trypanosomes are indicated in heavy type is reproduced. A plate depicts the more important trypanosomes.

H. B. Fantham.

HENNINGFELD (Fr.). **Ueber die Isolierung einzelner Trypanosomen.**—*Centralbl. f. Bakt.* 1. Abt. Orig. 1914. Mar. 21. Vol. 73. No. 3. pp. 228-240.

The author gives an account of a number of experiments made by him on the isolation of single trypanosomes and on the results obtained by inoculating single trypanosomes to mice. The strains of patho-

genic trypanosomes used were *Trypanosoma brucei* ("ferox" strain) and *T. equiperdum* (East Prussian strain, 1908). The practically non-pathogenic *T. theileri* of cattle was also used.

The isolation of the single trypanosomes was made by LINDNER's drop method and by means of the capillary tube. With the use of the capillary tube, they lived longer than when obtained by the drop method. When serum was used as the diluent, the maintenance of activity of the trypanosome was more prolonged than when salt solution or bouillon was employed. The infection of mice by single specimens of *T. brucei* and *T. equiperdum* was found to be easier than that of either *T. theileri* or the so-called cultural flagellates of cattle blood, the latter being relatively few in numbers. Attempts at subcultures from single cultural flagellates proved unsuccessful, nor could calves be infected by single *T. theileri*. Similarly, cultural flagellates were only transmissible to cattle when large quantities were inoculated.

H. B. F.

MARULLAZ (M.). **Contribution à l'Etude des Trypanosomes des Oiseaux, deux Espèces nouvelles.**—*Bull. Soc. Path. Exot.* 1914. Feb. Vol. 7. No. 2. pp. 115-117. With 7 text-figs.

Trypanosoma lagonosictae n.sp., was found in smears of the liver and lung of one specimen of the bird *Lagonosticta senegala*, a native of Equatorial Africa. The parasites were very rare, and those seen appeared to be monomorphic, 22μ to 25μ long (including free flagellum 2μ to 3μ) and 5μ to 7μ broad. The posterior (non-flagellar) end is sharply pointed and the flagellar border of the undulating membrane is relatively straight. Parasites were not seen in fresh blood, although seven birds were examined. Two trypanosomes are figured.

Trypanosoma liothricis, n.sp., is a large organism with folded membrane, found in the blood of *Liothrix luteus*, the Japanese nightingale. The parasite is very rare. Cultures of heart blood were made on simplified medium of NOVY, wherein the trypanosomes grew abundantly. In 12 to 15 days various cultural forms were seen, large, small, stumpy and rosettes. They were mostly crithidial in facies. These are figured and their dimensions are given. The author was unable to inoculate birds from cultures.

H. B. F.

MALARIA.

ZIEMANN (H.). **Ueber neuere Probleme der Tropenmedizin.** [New Problems in Tropical Medicine.]—*Zeitschr. f. Balneologie.* 1913-1914. Vol. 6. No. 23. pp. 1-10.

Professor Ziemann in an instructive address has broached a number of as yet unsolved and debatable problems for which he has various solutions to offer.

The tendency of the benign tertian parasite to gametocyte formation during the early summer months, just previous to the maximum prevalence of the anopheline definitive host, he attributes to the number of clinical relapses resulting from climatic causes in temperate zones during the months of April and May.

The prevalence of the different species of malarial parasites at different seasons of the year is also unexplained. Under experimental conditions the optimum temperature required to ensure development of these species has been found to be the same ; there is therefore no valid reason why the epidemiological curve of the different kinds of malaria should not be identical. [In contrast to this statement GRASSI, JANCSO and others have pointed out that the subtertian parasite demands a higher temperature for its development in the mosquito than suffices for the tertian and quartan.] This peculiarity Ziemann attempts to explain by drawing an analogy with the vegetable kingdom in which the prevalence of different flowering species at different seasons of the year is a matter of common observation ; that the sporozoites are incapable of surviving the winter in a hibernating mosquito appears certain, both from the work of Indian workers and of Ziemann himself in Wilhelmshafen.

No satisfactory explanation of great malarial pandemics in regions endemic to malaria has ever yet been advanced. The author considers that a combination of circumstances, all of which are not yet sufficiently understood, are necessary, such as numbers of gamete carriers, the presence of the suitable anophelines and certain climatic factors, as humidity, sunshine, wind and electric state of the atmosphere. It is also possible that the nature of the food, as for instance, certain plant juices ingested by the mosquitoes, has a definite inhibitive or stimulating action on the development of the parasites in the bodies of these insects.

It is instructive to note that a distinction between recrudescences of malarial infection, which can take place eight days after the original attack, and true relapses is drawn and that no support is found in artificial cultures at least for SCHAUDINN'S hypothesis, by which he attempted to explain the latent stage of the parasite by a parthenogenesis of the macrogametocyte in the internal organs. Ziemann is inclined to postulate a small residual schizogonic infection.

The incubation period of malaria is also subject to great variation ; under normal conditions it is 12–14 days, but it may extend over months and even one and a half years, as in a case which Ziemann himself observed. For the diagnosis of latent malaria the mononuclear leucocytosis is of the greatest, urobilinuria (PLEHN) of the least value. Complement-fixation reactions will probably be utilized in the future in diagnosis and possibly, since the author has been able to grow piroplasma by cultural methods even when sparse in the peripheral

blood, blood cultures will be useful for diagnostic purposes by demonstrating latent parasites.

As regards the artificial culture of malaria parasites Ziemann states that the following conclusions can be safely drawn :—

(1) That no conjugation or parthenogenesis of the parasites takes place in culture.

(2) That no transmigration of parasites from one corpuscle to another takes place.

(3) That the different species retain their morphological and biological characters in culture.

(4) That a certain number of malignant subtertian parasites become crescent forms.

On the other hand he has been unable to confirm Bass in one point, namely that it is possible to cultivate the parasites *ad infinitum* without the intervention of a sporogonic cycle.

The presence of dextrose in the culture appears to prevent haemolysis and to facilitate the penetration of the red cells by the young merozoites.

As regards therapeutic measures the author is of the opinion that it is desirable to discover other remedies besides quinine or salvarsan. He considers that endemic malaria of certain countries, as for instance in the South of Brazil, is resistant to quinine, perhaps because the natives of that country have been in the habit of taking that drug for many hundreds of years. As regards prophylaxis the author is in favour of small daily doses in preference to large weekly doses of quinine, his preference for the former being based on the ascertained fact that all the drug is excreted from the body by the third day.

P. H. Bahr.

Stephens (J. W. W.). **A New Malaria Parasite of Man.**—*Proc. Roy. Soc.* 1914. Apr. 8. Vol. B 87. No. B 596. pp. 375-377. With 1 coloured and 2 black and white plates; and *Ann. Trop. Med. & Parasit.* 1914. Apr. 21. Vol. 8. No. 1. pp. 119-124.

While examining a malarial blood film from the Central Provinces of India Stephens was struck by the peculiar appearance of the parasite, which he was inclined to regard at first as the malignant tertian parasite (*Plasmodium falciparum*). It exhibits the following peculiarities :—

1. It is extremely amoeboid (judging from the stained specimens).
2. The cytoplasm is scanty.
3. The nuclear protoplasm is out of proportion to the volume of the parasite.

It differs from *P. falciparum* in its amoeboid activity, and in the abundance and irregularity of nuclear matter; from *P. vivax* it can be distinguished by its smaller size, delicate nature of its amoeboid processes, the irregularity of its chromatin, and the rarity of typical ring forms. It is not certain whether the parasite enlarges the host cell, whether it is pigmented or not, or whether Schüffner's dots are produced. These points must remain unsettled till further material is forthcoming. Professor Stephens proposes to call the new parasite *Plasmodium pertenue.*

P. H. B.

MALOUVIER. **Une Epidémie de Paludisme au Tonkin.**—*Bull. Soc. Path. Exot.* 1913. Dec. Vol. 6. No. 10. pp. 745-752. With a map.

The cultivated delta of Tonkin has, up to the present, always held a healthy reputation as regards malaria, whilst in the elevated and thickly wooded regions the disease is endemic.

Researches of the last few years have shown that malaria is spreading into the plains and may appear in epidemics, such as one (caused by the subtertian parasite) which raged in the rich and fertile Province of Sontay throughout the months of May, June and July of 1913. The author believes that, though it seems paradoxical, the spread of malaria with increasing civilization and prosperity is due to improved transport, which, as in the case of trypanosomiasis, has facilitated the import of the infection into districts previously immune.

For the treatment of natives intramuscular injections of quinine were employed, a method to which the natives at first objected. Free distribution of quinine was ordered as a prophylactic.

[This report is of considerable scientific interest especially in reference to the epidemiology of malaria in the Himalayas and the Malay States; it is to be regretted that no information about the mosquito fauna is given.]

P. H. B.

BOUFFARD (Gustave). **De quelques Considérations d'Ordre épidémiologique sur le Paludisme.**—*Bull. Soc. Path. Exot.* 1914. Jan. Vol. 7. No. 1. pp. 25-30.

Bouffard discusses the report by MALOUVIER, summarised above. In attempting to account for these epidemics of malaria in Tonkin the author stipulates for an over-production of gametocytes in the blood of recently infected natives and consequently for the infection of a proportionately larger number of anophelines than under normal circumstances. The malarial parasites of different countries, he thinks, exhibit different properties, such as in the rapidity of gamete formation, an observation which he has verified in French soldiers recently imported into Algiers and Morocco.

P. H. B.

MATHIS. **Considérations sur le Paludisme et la Filariose en Indochine.** [Clinique d'Outre-Mer.]—*Ann. d'Hyg. et Méd. Colon.* 1914. Jan.-Feb.-Mar. Vol. 17. No. 1. pp. 215-228.

The prevalence of malaria in the high lands of Indo-China as compared with the delta region is once more emphasized (see also above paper by MALOUVIER).

Blackwater fever appears to be fairly frequent and to have accounted for 12 per cent. of all European deaths from malaria during the last seventeen years. The author considers that undoubtedly malaria is the greatest scourge of this region. The results of a few investigations on the differential leucocyte count in native cases are recorded; there is no material divergence from the generally accepted malarial formula.

P. H. B.

JOUVEAU-DUBREUIL (H.). **Note sur le Paludisme à Tchentou (Setchouen, Chine occidentale).**—*Bull. Soc. Méd.-Chirurg. de l'Indochine.* 1914. Jan. Vol. 5. No. 1. pp. 32-37.

All known forms of malaria parasites are present at Tchentou. Though the subtertian forms 57·90 per cent of the total number of infections the author examined, it is interesting to note that cases of pernicious attacks appear to be extremely rare and no case of this description has ever been reported from Setchuen. The author believes an endemic hepatic cirrhosis to be a malarial complication. There is an annual fever season during the months of September, October and November, and no striking preponderance of any species of malaria parasite at any particular season of the year.

P. H. B.

DENEUFBOURG. **Paludisme observé dans le Corps d'Occupation de Chine [Chine du Nord].**—*Ann. d'Hyg. et Méd. Colon.* 1914. Jan.-Feb.-Mar. Vol. 17. No. 1. pp. 53-63.

In North China the French army of occupation suffers considerably from malaria ; in this paper it is stated that during the three months, August, September and October 1912, one hundred and twenty per thousand troops were invalided on that account ; cases were especially numerous in the newly-enlisted Colonial troops.

The malarial season begins in August, though the anophelines are most numerous in June and July. The low temperature experienced in November (when the thermometer often records 9° C of frost) is responsible for many severe relapses.

Only one case of blackwater fever has been recorded, and in this instance the primary malaria infection was contracted elsewhere. No record is given of the indigenous species of parasite, but it is definitely stated that crescents have never been found.

P. H. B.

BROQUET (Ch.). **Paludisme et Culicides au Petchili.**—*Bull. Soc. Path. Exot.* 1914. Feb. Vol. 7. No. 2. pp. 110-112.

Petchili in the North of China, six kilometres from Tien-Tsin, has two distinct seasons—a severe winter from November to April, and a hot season from May to September. The commonest anopheline mosquito is *Myzorhynchus sinensis*, whose eggs are capable of surviving a considerable degree of cold. The appearance of the adult mosquitoes in the summer is, according to Broquet, synchronous with an outbreak of benign tertian malaria. Beyond this one observation he has been unable to adduce any evidence that this particular species is capable of acting as a malaria carrier in that region. P. H. B.

LÉGER. **Recherches au Laboratoire de Bamako (Soudan Français). Sur l'Index paludéen, l'Index filarien, la Tuberculose et la Trypanosomiase humaine.**—*Ann. d'Hyg. et Méd. Colon.* 1914. Jan.-Feb.-Mar. Vol. 17. No. 1. pp. 77-81.

To judge by figures given in this paper malaria must be extremely prevalent in the French Soudan. In a systematic series of 861 blood

examinations undertaken by Léger the parasite rate of 330 children under three years of age was found to be 94·65 per cent., and to be higher in the wet than in the dry season; the quartan parasite was by far the most widely distributed species; that double infections were only rarely met with (subtertian and quartan four times, subtertian and tertian once) is a remarkable fact.

Pyretophorus costalis is the most prevalent local anopheline.

[It is much to be desired that in papers of this kind a uniform scientific nomenclature of the malaria parasites could be adhered to; in the one under consideration the subtertian or malignant parasite is termed *Plasmodium praecox*, a name which was applied by Wasielewski in 1908 to the *Proteosoma grassii* Labbé 1894, and which has now by almost universal consent been superseded by that of *Plasmodium falciparum* Blan.]

P. H. B.

Brooke (Roger). **Concerning the Freedom of Cebu from Malarial Fever.**—*Military Surgeon.* 1914. Mar. Vol. 34. No. 3. pp. 201-204.

The town of Cebu in the Philippine Islands is free from endemic malaria. As far as is known, the topography and environment of the place are suitable to the existence and multiplication of anophelines, of which two species occur, *Myzomyia rossii* and *ludlowi*; the former is generally acknowledged to play no part in the transmission of the malaria parasite, the latter Brooke considers is incapable of serving as a definitive host for the parasite in Cebu.

[In view of Christophers's work on the part played by *M. ludlowi* in the spread of malaria in the Andamans, it would be well if these general observations were supplemented by experimental evidence.]

P. H. B.

Treatment.

Izar (G.) & Nicosia (R.). **Ueber Chemotherapie bei Malaria.**—*Berlin. klin. Wochenschr.* 1914. Mar. 2. Vol. 51. No. 9. pp. 385-391. and Mar. 9. No. 10. pp. 453-457. With 30 curves.

A therapeutic study on a series of 49 cases of malaria, undertaken in order to compare the effect of ethylhydrocuprein hydrochloride in doses of 1–1·5 grammes with that of similar doses of the bihydrochlorate of quinine; the intramuscular method of administration was employed throughout.

The authors elected to test this drug on man in consequence of Morgenroth's chemo-therapeutical researches on trypanosomes, in which the trypanocidal action of chinolin was found to be greatly augmented by the addition of an ethyl group as a side-chain.

They conclude that in benign as well as in the malignant infections, ethylhydrocuprein is much more efficacious than the bihydrochlorate of quinine. This superiority was especially noticeable in subtertian infections failing to yield to the latter drug. They lay special stress upon the constancy of its action, which suggests an affinity of the drug for the parasites in all stages of their development, and upon the rapidity with which they disappear from the peripheral blood.

No relapses occurred in the subtertian cases treated in this manner, though they were frequent enough in all six control cases treated with quinine bihydrochlorate alone. No symptoms of cinchonism were noted, and the patients themselves soon recognized the effects of the new drug and asked for it.

[The observations are open to one criticism; one gathers that the cases were partly studied from a travelling dispensary in the districts of Catania and Palermo, Sicily and on that account they could not be controlled as well as hospital patients. Those interested in this subject are referred to papers by GIEMSA and WERNER (see this *Bulletin*, Vol. 3, p. 257), and MACGILCHRIST, *loc. cit.*, p. 147.]

P. H. B.

CHRISTIN (E. F.). **Traitement arsenical d'un Cas de Purpura d'Origine probable Paludéenne.**—*Rev. de Méd. et d'Hyg. Tropicales.* 1913. Vol. 10. No. 4. pp. 208-211.

A case of purpura involving both the skin and mucous membranes and occurring in a chronic malarious subject who had marked anaemia and leucopenia. Injections of cacodylate of soda gave rise to large ecchymoses. All symptoms of malaria, and the purpuric patches as well, completely disappeared after a three weeks course of the arsenical waters of La Bourboule.

P. H. B.

PROPHYLAXIS.

IBBA (Ferruccio). **La Malaria nel Comune d'Iglesias durante il 1913.** —*Propaganda Antimalarica.* 1913. Dec. 31. Vol. 6. No. 5. pp. 132-139.

An account of the progress made in combating the effects of malaria in the commune of Iglesias, in Sardinia, in the year 1913. In a population of 22,000 inhabitants, partly urban and partly rural, a proportion of 4·2 per cent. were attacked by fever with a mortality of 1·5 per cent., or 14 deaths out of 924 cases. Of the 14 deaths 12 occurred in children and 2 in adults. The quinine distributed for prophylactic purposes amounted in round numbers to 45,000 grammes, or about 2 grammes per inhabitant; and in addition, about 9,000 grammes were used for the treatment of cases, or about 10 grammes per case.

J. B. Nias.

GENOVESE (Francesco). **La Patologia del Lavoro (Malaria) fra gli Operai Agrumari in Calabria.** [The Unhealthiness of Labour Conditions amongst the Fruit-Pickers of Calabria.]—*Propaganda Antimalarica.* 1914. Feb. 28. Vol. 7. No. 1. pp. 19-22.

Formerly the orange-harvest in Calabria did not begin till the opening days of the month of December, a time when all danger of malarial infection is practically over, but at the present time the exigencies of the foreign fruit-trade require that the picking of unripe fruit for export should commence in October, with the result that there is a good deal of malaria to be met with amongst the fruit-pickers, mostly

immigrants from neighbouring districts. It is suggested by the writer of this paper that these labourers should come provided with the necessary amount of quinine for self-administration during their stay, being supplied by their own local authorities, distribution on the spot being impracticable on account of the number involved. The conditions of housing and feeding amongst these migratory workers would seem to be deplorable.

J. B. N.

Rossi (Giacomo). **La Malaria nella Valle dell'Enza e l'Anofelismo senza Malaria.** [Malaria in the Valley of the Enza, and the Possibility of the Existence of Mosquitoes without Malaria.]—*Propaganda Antimalarica.* 1914. Feb. 28. Vol. 7. No. 1. pp. 1-11. With 4 text figs.

A discussion of the telluric conditions existing in the valley of the river Enza, a tributary of the Po, and their bearing on the prevalence of malaria. The author elaborates the favourite Italian theory that it is possible to get rid of malaria without getting rid of the mosquito.

J. B. N.

Brignone (Emiliano). **La Propaganda e Profilassi Antimalarica nelle Scuole Comunali di Terranova Monferrato durante l'Anno 1913.** [Antimalarial Propaganda and Prophylaxis in the Communal Schools of Terranova Monferrato during the Year 1913.]—*Propaganda Antimalarica.* 1914. Feb. 28. Vol. 7. No. 1. pp. 12-15.

Tarasconi (Luigi). **Profilassi Antimalarica Scolastica nell'Anno 1911 in Serramanna.**—*Ibid.* 1913. Dec. 31. Vol. 6. No. 6. pp. 139-141.

A local report of the type with which readers of this periodical are familiar. The children of the elementary schools of the district named received during the period extending from the 1st March to the end of June a tablet containing 20 centigrammes of quinine, three times a week, with the result that only one case of malarial fever occurred amongst 303 children.

Similar figures are given for Serramanna in Sardinia.

J. B. N.

Celli (Angelo). **La Malaria in Italia durante il 1911. Ricerche Epidemiologiche e Profilattiche.** [Malaria in Italy during 1911.]—*Propaganda Antimalarica.* 1913. Aug. 31. Vol. 6. No. 4. pp. 73-81 and Oct. 31. No. 5. pp. 97-106.

Professor Celli's annual report on the progress of the anti-malarial campaign in Italy. The methods adopted were the same as in former years. The tendency of expert opinion in Italy is to regard the extermination of the mosquito as a thing impossible of practical accomplishment under the local conditions prevailing, reliance being chiefly placed

upon the cinchonization of the population by means of quinine. How far this is an example to be followed elsewhere must remain an interesting question.

J. B. N.

ALLAIN (J.). **Paludisme et Quinine d'Etat en Annam pendant l'Année 1912.**—*Bull. Soc. Path. Exot.* 1913. Dec. Vol. 6. No. 10. pp. 730-744.

This is apparently a Government report on the antimalarial administrative measures undertaken in Annam during 1913. Quinine, of which 100,000 tubes were sold in eight months, is readily taken by the natives.

For prophylaxis quinine sulphate is given daily in gradually increasing doses of from 25 cg. to 1 gramme, and in decreasing doses of the same ratio for the next few days; for curative treatment doses of 1 gramme daily for the first three, 75 cg. for successive three, 50 cg. for the 7th, 8th, and 9th, and 25 cg. for the 10th, 11th and 12th days, are considered sufficient.

P. H. B.

CULTIVATION.

BASS (C. C.). **Cultivation of Malarial Plasmodia in vitro.**—*Amer. Jl. Trop. Dis. & Prevent. Med.* 1914. Feb. Vol. 1. No. 8. pp. 546-564. With 4 plates.

In this paper Bass gives a summary of his own more recent work and that of others on this subject (see this *Bulletin*, Vol. 1., pp. 22–24; Vol. 2, pp. 9 and 10; pp. 224 and 225; p. 340; Vol. 3, pp. 58 and 59; p. 260).

With modification of the same technique ZIEMANN first succeeded in cultivating *Piroplasma canis* (see this *Bulletin*, Vol. 2, p. 224); latterly also BASS and JOHNS have noted a multiplication of *P. bigeminum*.

The technique for cultivation of one generation only of parasites is very simple, but to obtain further subcultures it is necessary to eliminate the ubiquitous phagocyte.

The apparatus and materials required.

1. Syringe and needle (Fig. 1, 1) for collecting the blood from a vein; an all-glass syringe of 20 c.c. capacity is convenient for the purpose. A coarse needle is necessary to prevent suction which alters the cells and kills the parasites in a short time.

2. Defibrinating tube (Fig. 1, 2) of 2½ cm. diameter and of a length suitable for the centrifuge. This tube is plugged with a cotton plug having a plain glass rod running through it and extending to the bottom. It has been found more satisfactory to substitute a glass tube for the glass rod, in which case the outer end is connected to a needle by means of a short rubber tube (Fig. 1, 3); this rubber can be dispensed with and a platino iridium needle welded directly into the tubing. Blood is collected by inserting the needle directly into a distended vein.

3. Culture tubes (Fig. 1, 4) not less than 1·25 cm. in diameter by 12·5 cm. deep.

4. Graduated pipette (Fig. 1, 10) 1 cc. graduated in hundredths.

5. Merck's dextrose 50 per cent. solution in water sterilized at 100° C. for three consecutive days.

6. Capillary pipettes (Fig. 1, 8) made from glass tubing of ·5 to ·6 cm. in diameter. Before sterilization the broader end should be plugged with cotton fitted with a rubber teat of the best quality.

7. The incubator should be regulated to a temperature of 40° C., though it is possible to use one at a temperature as low as 38° C. Sometimes the parasites grow well at a still lower temperature.

8. A centrifuge running at a speed of 800–2,000 revolutions per minute; higher speed centrifuges tend to destroy the parasites.

9. Culture tubes 12·5 cm. by 1·25 cm. with a flat bottom (Fig. 5) or (Fig. 6) provided with a disc of white filter paper supported from the bottom of the tube by a piece of glass tubing.

10. Plain pipettes (Fig. 1, 9) of a 5 to 20 cc. capacity of which the broader end is plugged with sterile cotton wool and the narrower end hermetically sealed.

11. A rubber tube 50 cm. long provided with a mouth piece and pinch cock (Fig. 1, 11). This tube should be of a proper size so as to fit on to the necks of the pipettes just described.

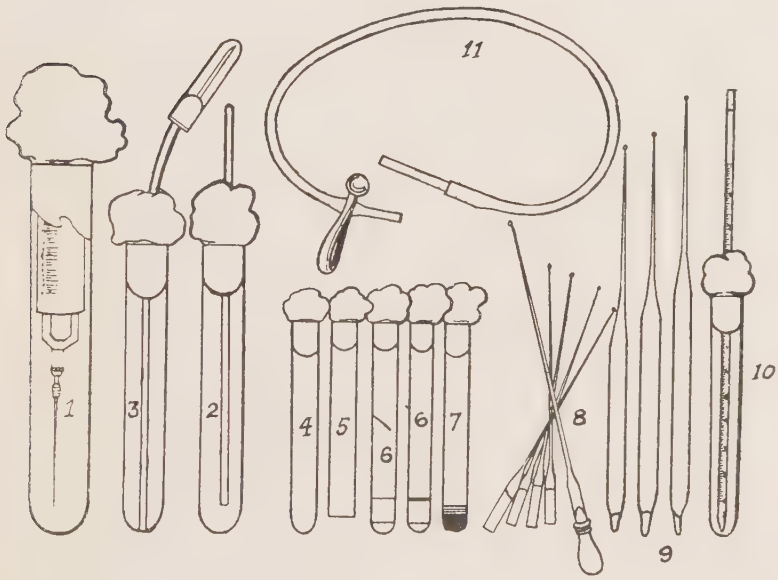

FIG. 1.

1. Syringe.
2. Defibrinating tube.
3. Defibrinating tube (with needle).
4. Culture tube (plain).
5. Culture tube (with flat bottom).
6. Culture tube (with paper shelf).
7. Culture tube with plasma in bottom.
8. Pipettes (small).
9. Pipettes (large).
10. Pipettes (graduated).
11. Rubber tube.

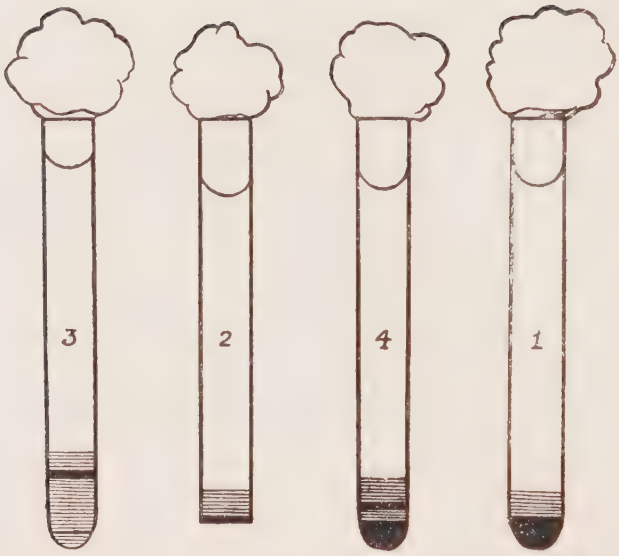

FIG. 2.—Culture on paper disk. Culture in flat bottom tube. Culture in plasma bottom tube. Ordinary form cultures.

Precautions. It is essential to sterilize all apparatus in a dry sterilizer; the addition of a few drops of water usually causes the death of the plasmodia. Care must be taken not to scorch the cotton plugs; the small amount of smoke thus produced suffices to kill all the parasites in a culture.

Technique employed for cultivation of one generation of parasites.—Blood is collected from the vein and expelled directly into the defibrinating tube; the latter should be tilted to one side to avoid unnecessary exposure to the air. One tenth of a cubic centimeter of the 50 per cent. dextrose solution is placed in the defibrinating tube for every 10 cubic centimeters of blood.

Defibrination is effected by whipping or stirring with the glass rod which extends through the cotton wool plug. The whipping in of air causing bubbles must be avoided. This defibrinated dextrose blood containing plasmodia may be transferred to other tubes or incubated in the original one; in any event the column of blood must be 2·5–5 cm. deep, yielding a column of serum of 1·25–2·5 cm. above the precipitated cells and parasites; should the supernatant serum be shallower the parasites tend to die out. Under the most favourable circumstances they only live and develop at the top of the column of precipitated cells and may be examined at any time by withdrawing a small amount of fluid by means of a sterile capillary pipette. Some considerable practice is required in order to do this without withdrawing cells and dead parasites situated beneath this layer at the same time. Care must be taken in handling tubes containing cultures to keep them in an upright position; tilting to one side results in burying and killing the living parasites at the top of the column of cells.

Technique employed for cultivation of more than one generation of parasites.—It is essential to remove the leucocytes at the time the

culture is made, in order to avoid destruction of the parasites by them at the time of segmentation. The malarial blood is centrifuged sufficiently to force the leucocytes to the surface; unnecessary centrifugation should be avoided.

The supernatant serum is drawn off into flat bottomed culture tubes; cells and plasmodia are carefully drawn from the middle of the centrifuged cells and planted at the bottom of the serum in these tubes; about one to two tenths of a cubic centimetre of cells in a half inch tube make the thickest layer in which it is possible to procure a homogeneous growth of parasites. By employing tubes with a paper disc suspended in them and filled with serum to at least 1·25 cm. above the level of the disc it is possible to secure a growth of parasites in about twice the amount of cells already mentioned.

By employing coagulated human blood plasma with the addition of 1·25 cm. of fresh dextrose serum, over the surface of which cells and parasites from the centrifuged and defibrinated blood are carefully distributed, a layer of live parasites ·25 cm. thick may be obtained; generally the parasites die out after the first segmentation. In order to obtain further cultures it is necessary to transfer a portion of the cells and parasites to a recently prepared tube containing fresh cells and serum. This transplantation should be done within four or five hours of the time of maximum segmentation.

Influence of dextrose in cultures.—Attempts made to grow the parasites without the addition of dextrose have always failed; the protoplasm of the parasite rapidly degenerates. Dextrose added to these cultures fails to revive them. Maltose is the only sugar which can act as a substitute for dextrose, though it is by no means certain whether it does so *per se* or whether it acts by being first converted into dextrose. Should haemolysis be produced the infected cells haemolyse first and the parasites die out. So essential is dextrose that blood removed from a subject after a full meal affords a much more suitable medium than that of the same person withdrawn while fasting, though when present in too high a proportion it delays the growth of the parasites. It was found that plasmodia will develop in the presence of media other than blood serum. Both the tertian and the subtertian parasite will grow feebly in Locke's fluid without the addition of calcium chloride, and also in different ascitic fluids, of course in both cases with the necessary addition of human erythrocytes; being unable to exist even for a few minutes free in the serum they cannot grow independently of the cells. The leucocytes are capable of ingesting the free merozoites only and not the intracellular trophozoites.

Bass believes, as a result of numerous observations on plasmodium growing *in vitro*, that *in vivo* they can only pass from cell to cell when one is in direct contact with another containing a segmenting parasite, and then only when the opening for the exit of merozoites occurs opposite the cell to be infected. The protoplasm of the parasites is of a firmer consistency than that of the red cell and as a result of this feature they are capable, after having attained a sufficient size, of lodging and remaining fixed in the capillaries, wherever the current is weakest; here segmentation takes place. Considered in this light plugging of the capillaries to a degree sufficient to produce coma becomes intelligible. The haemolysing effect of calcium salts on

cultures of the subtertian parasite *in vitro*, which Bass has recently substantiated as a result of his experiments, and which exerts no such influence on normal blood, may yet provide the key to the pathogenesis of malarial haemoglobinuria

P. H. B.

NOCHT (B.). **Bemerkung zu der Arbeit von Prof. Ziemann "Weiteres über die Züchtung der Malariaparasiten und der Piroplasmen in vitro."** (Archiv für Schiffs- und Tropenhygiene, Bd. 18, Heft 3). [Remarks on the Work of Prof. Ziemann "On the Cultivation of Malaria Parasites and Piroplasmata in vitro."]—*Arch. f. Schiffs.- u. Trop.-Hyg.* 1914. Mar. Vol. 18. No. 5. pp. 166-167.

Da ROCHA-LIMA and WERNER have asserted* that Nocht had succeeded many years ago in obtaining a multiplication of schizonts in vitro. Though admitting the truth of this assertion Nocht states that he did not consider his work worthy of publication at the time, as he did not succeed in cultivating the parasites for more than one generation.

P. H. B.

SULDEY (E. W.). **Importance de la Formule leucocytaire dans le Diagnostic différentiel de l'Hépatite paludéenne et de l'Hépatite suppurée.**—*Ann. d'Hyg. et Méd. Colon.* 1914. Jan.-Feb.-Mar. Vol. 17. No. 1. pp. 71-77.

The conclusions of this paper may be stated as follows :—

(1) A more or less accentuated leucocytosis denotes a hepatic suppuration, unless some other obvious septic focus exists.

(2) A neutrophile hypoleucocytosis associated with an evident mononuclear leucocytosis denotes a malarial hepatitis.

P. H. B.

**Arch. f. Schiffs- u. Trop.-Hyg.* 1913. Vol. 17. p. 541.

BLACKWATER FEVER.

BOYÉ (L.). **Relations entre la Consommation de la Quinine et la Fréquence de la Fièvre Bilieuse Hémoglobinurique au Tonkin.**—*Ann. d'Hyg. et Méd. Colon.* 1914. Jan.-Feb.-Mar. Vol. 17. No. 1. pp. 68-71.

An analysis compiled from official malaria and blackwater fever returns among the 7,990 European and 11,150 native Colonial troops employed in Tonkin during the last twelve years, with special reference to the compulsory quinine prophylaxis during the last eight years.

From these returns it was possible to construct a table showing the frequency of the disease and death rate from this cause per 1,000 (European and native troops).

Years.	Europeans.		Natives.	
	Morbidity per 1000 effectives.	Mortality per 100 cases.	Morbidity per 1000 effectives.	Mortality per 100 cases.
1902	2·0	35·0	6·7	34·5
1903	3·3	35·2	7·2	31·3
1904	2·4	34·6	6·0	19·2
1905	4·6	18·4	5·5	8·5
1906	·8	42·8	5·3	31·2
1907	·5	33·3	6·2	11·1
Mean	2·2	33·2	6·1	22·6
1908	2·1	42·8	2·6	30·7
1909	·9	0·0	5·5	38·4
1910	3·0	9·0	8·0	12·1
1911	·3	0·0	5·9	12·5
1912	·5	25·0	8·0	19·7
1913	·1	0·0	3·4	12·1
Mean	1·1	12·8	5·5	20·9

The case incidence amongst Europeans has fallen within the periods 1908–1911 to one half and the death rate by 20·4 per cent. of the figure for the previous seven years; amongst the native troops, however, the improvement has by no means been so uniform. More striking than the malaria reduction is the diminution in the amount of blackwater fever which has taken place since this compulsory quinine prophylaxis has been introduced, in spite of active military operations involving physical strain and exposure (factors which, as is well known, predispose to blackwater fever) which the troops under consideration have had to undertake during the last six years.

The author deduces from a study of these figures that in Tonkin at

least quinine may be definitely excluded as an aetiological factor in the production of blackwater fever [see also papers by MALOUVIER and ALLAIN].

P. H. B.

BIJON. **Quelques Résultats Expérimentaux au Sujet de la Pathogénie de la Fièvre Bilieuse Hémoglobinurique.**—*Ann. d'Hyg. et Méd. Colon.* 1914. Jan.-Feb.-Mar. Vol. 17. No. 1. pp. 64-68.

A record of a few, not very convincing, experiments on rabbits, undertaken in order to test in vitro the corpuscular resistance to dehaemoglobinization after previous injections with quinine.

The conclusions may be stated shortly as follows :—the haemolytic action of quinine is only manifest for a few days after the injection. It is probable that some anti-haemolytic body is produced in the serum, but should quinine be injected during a period in which this substance is either absent or has been completely absorbed from the blood stream, haemoglobinuria will result. This hypothetical body is but slowly produced, with the result that the corpuscular resistance to dehaemoglobinization is diminished as long as eleven or twelve days after the last quinine injection.

P. H. B.

SOERENSEN (N.). **Die Urobilinsekretion im Harne bei Malaria, besonders beim Schwarzwasserfieber.** [The Secretion of Urobilin in Malaria and especially in Blackwater Fever.]—*Arch. f. Schiffs- u. Trop.-Hyg.* 1914. Mar. Vol. 18. No. 5. pp. 159-163.

Soerensen has continued PLEHN's work on this subject* in the Island of Flores, one of the Sunda Islands. Of the malaria parasites found in the island, the subtertian and quartan are the most abundant. Schlesinger's test for urobilin (zinc acetate in alcoholic solution and iodine in potassium iodide solution) was employed ; a green fluorescence denotes a positive reaction. The author believes that urobilin can be quantitatively estimated in a rough manner by progressive dilution of the urine and by watching the intensity of the spectroscopic bands.

Two or four days after defervescence of fever the reaction was no longer present, though its reappearance invariably presages a relapse ; in one case it was noted in especially large quantities twenty-four hours before the onset of blackwater.

This observation he applied to other cases and was thereby enabled to foretell the onset and to forewarn the patient of blackwater in fifteen instances ; and sometimes, he believes, by promptly applying a vigorous quinine treatment, was enabled to ward off the attack.

P. H. B.

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*PLEHN (A.). The Diagnosis of Latent Malaria.—*Brit. Med. Jl.*, 1908. Oct. 31. p. 1357.

PATTON (Walter Scott). [M.B. (Edin.), I.M.S.] & CRAGG (Francis Wm.) [M.D. (Edin.), I.M.S.]. **A Textbook of Medical Entomology.** —xxxiii+764 pp. cr. 8vo. with 89 plates. 1913. London, Madras & Calcutta; Christian Literature Society for India. [£1-1*s*. net. or Rupees 15-2 net.]

The most original features of this encyclopaedic work are manifested in its conscientious anatomical descriptions, and in its attentive and instructive treatment of methods of breeding and manipulation of insects in the laboratory; these give it its essential character as a sound book of reference for those who wish to investigate experimentally the natural history of insect-borne disease. Both actual and potential agents of infection are included, the groups considered being the *Chironomidae, Simuliidae, Psychodidae, Culicidae, Tabanidae, Muscidae*, and Pupipara, among Flies; the Fleas; the *Rhynchota* and Lice; the Ticks, and to a limited extent the Mites; the *Linguatulida*; and *Cyclops*. Each group is treated systematically and comprehensively in its particular pathogenic relations; external characters, both larval and adult; habits, habitat, and life-history; incidence, seasonal prevalence, etc.; classification and generic and specific composition; internal structure and methods of dissection; collection and preservation; and breeding and maintenance for laboratory requirements. The Classification includes tables and catalogues for the recognition of genera and species, and descriptions and notable particulars of all species of acknowledged pathogenic significance; and the accounts of internal structure always comprise a critical exposition of the mouth-parts and of all those structures and organs that are in any way implicated in the process of acquiring, harbouring, and transmitting infection; while to every group a useful bibliography is appended. Where the work goes beyond this well-conceived and well-executed programme it has some vulnerable points. This is particularly so among the first 150 of its 745 pages, which are occupied with a long account of the comparative anatomy—with an occasional diversion into phylogeny—of blood-sucking Diptera as a whole. These 150 pages certainly teem with interesting and pertinent facts; but they are rather too much permeated with interpretations and ingenious speculations, and even with assumptions that, however elevating, are somewhat out of place in a treatise on applied entomology. A certain amount of well-sifted speculation gives salt and savour to any text-book; but the critical reader will always reflect that in comparing the fully-formed structures of adult animals the most contradictory hypotheses can be supported by the same facts, and that theories of homology and of phyletic precedence that are not founded on verifiable facts of development are not capable of bearing a lasting strain, however plausible they may appear.

In the explicitly technical part of the book the authors introduce a large amount of original work. This is evident in the pages on the blood-sucking *Muscidae*, where also attention is directed particularly to the species of *Musca* which, though not furnished with any special means of drawing blood, yet are habitually haematophagous, getting their fill by playing jackal or bully to the truly mordacious species of their own and other families. Even when they traverse ground that is not altogether unfamiliar to entomologists the authors have much to communicate in the way of confirmation, emendation, and amplification, particularly in their careful accounts of the anatomy of *Tabanus, Conorhinus, Cimex*, and *Pediculus*.

Nearly 90 pages are allotted to the Mosquitoes, where the authors do not commit themselves definitely to any particular scheme of classification. Brief diagnoses are given of almost all the known species of *Anopheles*, in a convenient geographical arrangement. The species of *Anopheles* known or reputed to be natural carriers of malaria are treated with proper emphasis, and the characteristic features of the larvae—so far as they are known—are distinguished.

In the account of the *Tabanidae* novel and valuable directions for collecting and rearing larvae are given.

In the chapter on *Rhynchota* the authors go a little off the track—possibly with an eye to the pursuit of flagellates that are harboured by various

species of plant-bugs—to bring in a synopsis, taken from DISTANT's volume in the *Fauna of British India*, of all the constituent Oriental families of the order. The blood-sucking genus *Conorhinus* is treated in commendable detail, but one must inquire why the authors have changed the good name *Conorhinus sanguisuga* to *sanguisugus*; *sanguisuga* is a feminine noun substantive, meaning a leech; an adjective *sanguisugus* is non-existent, and is non-consistent with the regulations of Latin grammar.

More than 100 pages are devoted to the Ticks, the dissection of these parasites, and the methods of breeding them and of manipulating them for experimental work being described in great detail.

There is a useful chapter on laboratory technique—dissection, section-cutting, mounting, etc. For decolourising chitin the authors do not notice the use of peroxide of hydrogen—which is generally regarded as the simplest method.

The illustrations are abundant and adequate, filling 89 large plates. The original drawings must be of superlative excellence, as is evidenced by those plates—e.g. xl-xlix and the plates of *Anopheles*—in which they have been artistically reproduced, but justice has not been done to them in many of the reproductions, which are of coarse and heavy texture.

The authors seem to the reviewer to be unnecessarily sarcastic in styling a colleague who attends to the specific characters of mosquitoes a "culicidologist." Nor is it intelligible why if *Stomoxys* and its relatives are to be isolated in a subfamily, that subfamily should be called *Stomoxydinae*; unless, indeed, it be argued that as the name *Stomoxys* is an unusual compound it has no established claim to respect.

Small specks on the surface, however, do not dim the general lustre. In the words of its sponsor, the book "will be extremely useful to all workers in Medical Entomology, and I trust that it will meet with the success which it undoubtedly deserves."

A. Alcock.

May 15, 1914.]

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[A record of straightforward benign tertian malaria in an Anglo-Indian girl of 3¾ years.]

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[A popular address on the social status of the Italian and Sicilian field labourers together with the methods adopted by the Government authorities in the prevention of malaria in rural districts.]

Mereu (Francesco). Lavoro e Malaria nella Miniera Argentiera della Nurra.—*Malaria e Malat. d. Paesi Caldi.*, 1914. Feb. Vol. 5. No. 1, pp. 6–13.

[The silver-mine workers are especially liable to malaria; adult males are mostly affected, women and children also, but to a less degree. The subtertian parasite appears to be almost as numerous as the benign.]

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[The author considers that the night atmospheric conditions at the island of Walcheren in August are such as to afford an explanation of the mild intermittent fevers which still linger there. [See this *Bulletin* Vol. 2, p. 545.]

PATTERSON (A. H.). Diabetes insipidus—complicating Malaria.—*China Med. Jl.*, 1914. Jan. Vol. 28. No. 1, pp. 18–19.

[A case of polyuria following a straightforward malarial attack, which yielded to quinine.]

PEIPER (Otto). Ueber Malariabehandlung mit Hydrochinin. Ueber Papatacifieber.—*Arch. f. Schiffs- u. Trop.-Hyg.*, 1914. Apr. Vol. 18. No. 7, pp. 221–232.

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